73 AMATEUR RADIO

International Edition

JANUARY 1990
ISSUE #352
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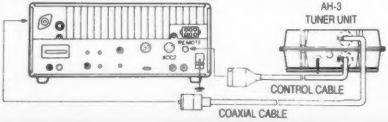
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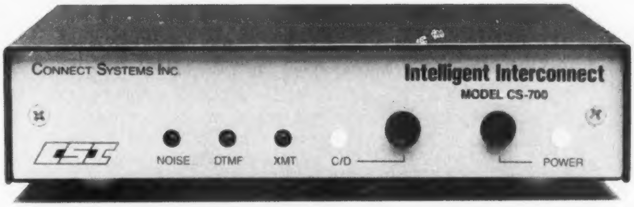

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WELCOME NEWCOMERS

The Spirit of Home-Brew

Almost every day one of us in the editorial office receives a call from an amateur radio operator who's excited about something he's **home-brewing** or **modifying**.

"It may not work as well as a commercial transceiver, but I get more satisfaction out of operating it."

"Everybody told me it couldn't be done, but I'm doing it, and I want to send you an article on it as soon as I'm finished testing it."

"It's just so much fun to use something you've put together yourself. You know it inside and out, and if you want to modify it, you don't have to guess about what's inside."

Our callers are more than excited; often their tone of voice conveys religious joy in the art of creating something that didn't exist before. And what is more religious than creativity—than being a creator, with at least a small "c"?

Sure, the transceiver already existed before our caller built his—but *his* transceiver didn't. It's one of a kind. His transceiver is his baby, and he's proud of it.

Of course, sometimes hams do invent new equipment, such as a type of meter or relay or filter that didn't exist before. Or they use existing equipment and parts in ways that no one else has done before. But whether a ham starts from scratch or just slightly modifies his shiny, store-bought equipment to suit his needs, the feeling of satisfaction is much the same. Only the intensity varies, depending on the person's perception of his accomplishment.

At bottom, the spirit of home-brew is the spirit of **creativity**. Other people know this spirit in other ways, such as in building a house, tastefully disguising leftovers, painting a picture, writing a book, or discovering a new way of doing business.

Modifications are Home-Brew, Too!

How often have you bought a piece of commercial equipment that was absolutely perfect in every respect for *your* needs?

Modifications are popular. In 1989, *73* published 26 articles on modifications for existing equipment, in addition to 78 home-brew construction projects. See the "1989 Annual Index" in the December 1989 issue for a list. The Uniden modifications have been some of the most popular this year. When you look over the "1989 Annual Index," also note that any updates (corrections, additional information, etc.) in following issues are referenced right below the article entry so that you can find them easily.

Many people inherit or buy **CB** equipment which they wish to convert for operation on the **amateur radio bands.** We receive many requests for copies of CB-to-10 articles, the earliest in this series dating back to May 1977 (end an SASE for a list). Apparently, the early CB-to-10 articles are still useful. Which brings up a point: If you have used the information a CB-to-10 article to modify equipment, please write or call us about the results.

Modifying used equipment is an alternative to buying expensive new equipment. If you enjoy working with tools and the innards of radios, you can customize your equipment and economize at the same time. However, the following warning applies to modifications as well as **repairs**.

Beware of Repairs

Repairing your equipment is another aspect of the home-brew, do-it-yourself way of thinking. Before you take the screwdriver to your new commercial **rig** to explore the possibility of repairing it yourself, read KB1UM's column on "Fix or Ship?" in the June 1989 issue of *73*. What if you blow it (metaphorically speaking, I hope) and void your warranty? What if, in spite of your best intentions, you not only fail to fix, but further damage, your rig? KB1UM tells you how to decide what to do so that you can avoid trouble.

Check the February, March, and August 1989 "Ask Kabooms" for advice on troubleshooting circuitry, knowing which **component** to suspect first, and how to go about reading schematics.

Essential Tools

Have you ever wished that you knew at least a little bit about construction techniques so that you could change just one or two items on a device? A little change can make a big difference. Maybe you'd prefer an LED to that annoying buzzer.

In the November "Welcome Newcomers," I mentioned *One Evening Electronics Projects,* by Calvin R. Graf and Richard S. Goss, as a good book for beginning construction. It's easy to understand and use. No words are wasted, but neither is it too sparse. Look for it in "Uncle Wayne's Bookshelf" in this issue. The 16 projects include modifications for your telephone, an audio continuity and voltage tester, polarity-sensing continuity tester using LEDs, "probevolt," LED voltage and polarity indicator, poweralert, a light-sensitive audio oscillator, and more.

Since then, I've come across another book while prowling around the bookshelves—*First Book of Modern Electronics Fun Projects,* edited by Art Salsberg and published by Howard W. Sams & Company. It has a good getting-started section as well as some useful electronics projects.

To begin, you need a few tools, some inexpensive parts, and a little knowledge, beginning with safety precautions. Ham books for beginners, such as *Tune in the World,* have photos of components to help you learn how to identify them, and descriptions of their characteristics, properties, and uses. For soldering, see WB9RRT's "Soldering Sidebar" in the August 1988 issue. Check "Tech Tips" for PC board fabrication and other information on how to do things faster, easier, and better. . . . de Linda KA1UKM

A Basic Tool Kit

- Soldering iron kit, including a desoldering device.
- Multimeter to measure voltage (in volts), current (in amperes), and resistance (in ohms, represented by Ω).
- IC (integrated circuit) extractor.
- Needle-nose pliers.
- Diagonal wire-cutting pliers.
- Blade and Phillips screwdrivers.
- Set of nut drivers.
- Wire stripper.
- A box for storing **junk**; i.e., valuable parts, components, and miscellaneous items from diverse sources.
- If necessary: A hiding place to keep your tools so that family members will have to ask before borrowing.
- If possible: A friend with experience and extras, such as an oscilloscope, a frequency counter, signal generator, etc.

Glossary

Amateur Radio Bands You must have an amateur radio operator's license to operate on the ham bands. There are different types of licenses with different privileges. The Novice license requires minimal theory and Morse code at 5 wpm. Privileges for this license include operating on six ham bands—the 80, 40, 15, 10, and 1.25 meter bands; and the 23 centimeter band—in specific modes, such as voice or CW (continuous wave, or Morse code).

CB Citizen's Band; the 11 meter band from 26.965–27.405 MHz. Anyone may operate CB without a license as long as FCC regulations pertaining to this band are observed.

Components Parts or devices in a circuit, such as resistors and capacitors.

Home-brew Do-it-yourself! Practicing creativity.

Junk Potentially valuable miscellany.

Modification You can modify a home-brewed or commercial device. Modifications range from very slight changes in existing equipment to massive overhauling.

PC Board Printed circuit board.

Repair A repair may sometimes be equivalent to a modification, especially by the manufacturer of new equipment for which you have a warranty. Modifications usually void the warranty.

Repairs which make the rig better than it was before it broke down, are certainly modifications. Simple "re-pairs" (for example, you reconnect a spring to a plastic part) only restore the equipment to its original condition.

Rig A ham radio, or transceiver that both receives and sends; a separate transmitter and receiver regarded as a unit.

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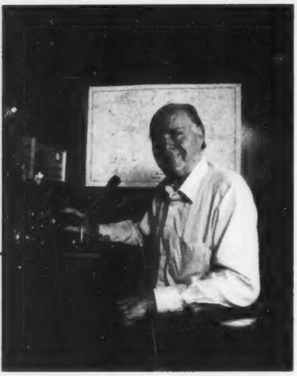

Ho Hum—No Growth Again

Judging from 99% of the ham club newsletters I read, there's almost zero interest in doing anything about preserving our hobby. Fine, if that's the way you really want it. Though I'll sure miss amateur radio, I've got enough other interests to keep me busy. Like this last weekend, for instance, when Sherry and I zipped over to Munich on a quick business trip.

Unless you're deaf, dumb and blind, you know that the FCC license counts are a disaster. For instance, during the first nine months of 1988 there were 31,000 license renewals. During the same period in 1989 we had 3,300. That's only a 90% drop in renewals, so what's to worry? We need new hams, not those old worn out retreads, right?

After all, Novice Enhancement and the enormous push by ham clubs to license newcomers has been fantastically successful. I know that's true because I read it in another ham magazine—and they wouldn't print it if is weren't true. But where have all these new hams gone?

The FCC figures show us with an actual growth of 0.1%. Well heck, that's a bummer, but I've been reading about the proposed new ARRL no-code license—just wait'll that hits! Sure. Like the same deal did in Canada, where in ten years they've attracted less than 100 takers. We're bigger, maybe we can pull in a thousand new hams in ten years.

They tried a similar no-code license in Britain, too. Didn't do much for them either. Maybe it's time to give up and sell our gear for what we can while the selling is good.

No-code really worked in Japan, but everyone knows they're smarter and much harder working than we are. They have a tremendous national pride—something we used to have and us old timers still remember with nostalgia. They're working hard for Japan and we're working half-heartedly for ourselves—as long as work doesn't interfere too much with our personal lives. Pass me another six-pack.

The way it looks to me is that the ham club newsletters I read reflect our grassroots. The message is clear: We really don't care. I'm getting the same message loud and clear from 90% of the ham industry, so all this controversy over no-code is just wheel-spinning. Much ado over nothing, to coin a phrase. No-code will only have some meaning if we're going to do something about promoting amateur radio.

Munich

One result of having a couple of darned good assistants is that I have a little more freedom to travel—at least on weekends. On the last few weekends I've been able to get away and give talks at the Huntsville and Louisville hamfests, go to Los Angeles for a Kenwood new product unveiling and I even went on a scuba-diving Caribbean trip. I'll put the story of that trip on the *73* BBS, in case you're interested in diving. It would take up too much room in 73, even though I know you'd enjoy my adventure.

So what about Munich? Well, a couple weeks ago there was a story on PBS radio about the new dance craze in Europe, the Lambada. I noted this for my wife, Sherry, who produces how-to-dance videos. A week later she saw the Lambada on a TV news report and decided it was getting time to produce a video.

Kathy, the star of her videos, had never heard of the Lambada—and worse, was unable to even find a dance teacher who knew how to do it. Well, it's popular in Europe, so let's go over and video tape some people dancing it so Kathy will be able to do a video.

I got in touch with some publishing friends in Munich and the next day we were on our way. We arrived Saturday afternoon and had our video done before midnight. We even found a dozen Lambada CDs in the local record stores!

The Lambada is a mixture of dirty dancing, the samba, bossa nova, tango, cha cha and a few other Brazilian dances. I interviewed a Brazilian dance teacher in Munich and was promised an article for my music magazine on it.

When I saw how enthusiastically the otherwise staid Germans went for the dance, I knew it would be big in America. I went along to help Sherry do a video, but I ended up deciding to import Lambada CDs and cassettes. They'll sell like crazy in a few months. And I'll bet Sherry's how-to video will be the best seller of her 60+ videos.

The dance is great fun, real easy to learn, and it's the closest thing to the sex act on the dance floor. The kids (of all ages) will love it.

Nope, no hamming. I'm going back in mid-February to Munich and then driving to Vienna, Crakow and Prague. I hope to meet ham groups then. Maybe you can help?

I'll be in London for the Thanksgiving long weekend. In January it's CES in Las Vegas, the annual ham skiing bash in Aspen (9-16th), then Cannes for a music conference at the end of the month.

I'll be in L.A. March 9–13th for a music conference, if there are any clubs who need an exhausted old ham speaker. Mobile (AL) April 5–6th for my Drum submarine reunion. Dayton the 26th. May 29–June 2 Nashville for another music conference. Chicago June 3–5th for CES. That's about all I've got on my 1990 dance card so far.

There's a fantastic scuba trip to a virgin reef in the Bahamas coming in July if you're into diving. I'm hearing from more and more ham divers interested in my organizing combo diving/ham visits to the rarer Caribbean Islands. Are you game? Want to cope with pileups?

With all that travel I won't have time to get to many hamfests—and even fewer ham club meetings. If your club would like to have me speak, here's how we can do it. I have a couple of 8mm video cameras here, so if you'll write down some questions that you'd like to have me answer or topics you'd like me to talk about, I'll get together with Jim Morrissett K6MH and we'll video my answers. We'll then copy the 8mm to VHS for you and send you the tape. I don't know how long it'll be—could easily run an hour.

The video quality won't be all that great—and I'm not about to spend $3,000 more to buy two new High-8 cameras so you'll get broadcast quality. But it'll be pretty good. It should be interesting meeting entertainment for you. Better than some guy from Public Service.

Send me $20 and your list of topics. That'll cover the blank tape, packing, mailing, with a little left for eventually buying better video equipment in case this gets popular.

I can talk about the time when we came "that close" to losing amateur radio. I was there, so I know what happened. I can talk about how hamming was fifty years ago—which you probably already know. I can talk about new ham technologies which can be developed. I can talk about education, welfare, drugs, the China mess, how to save amateur radio, entrepreneurialism, cutting college costs, no-code, how microcomputers got started, how Radio Shack saved IBM, why IBM is now in trouble, how Texas Instruments blew $800 million and threw away billions, how the Incentive Licensing disaster happened, the latest in low magnetic field developments, communicating with the dead and with alien civilizations, EMP, how life started, how the mind works, the old RTTY days, how hams started cellular radio, how repeaters got organized, how to clean up our bands, how to put K1MAN and KV4FV out of the jamming business, etc. What'll you have?

With some encouragement I'll build up a library of video talks which you'll be able to use to further discourage kids from coming to your club meetings.

Killer Blankets II

Dr. Ross Adey KU6I, in his presentation at the 1989 ARRL SW Division Convention on the effects of low energy 60 Hz magnetic fields on our bodies, had an interesting comment to make about the press: ". . . when the press says that this is controversial, what it really means is that the reporter is too uneducated and too stupid to understand what he has been told."

The November *Consumer Reports* devoted two pages to discussing the dangers of using electric blankets—and four pages to rating comforters to use instead. In case you don't read *CR* (tsk), one of their top recommendations is the L.L. Bean #8406KK at $84. They also gave good grades to Springs Performance Jeweltone Solids at $33. They found that goose down filling was no warmer than synthetic-filling, only a whole lot more expensive. That's good news for allergy-prone people like me.

By now, unless you are truly insulated from the real world by functional illiteracy (you can read, but you don't bother), you've been reading an increasing number of articles on the dangers of magnetic fields—such as in the Oct. 31st *Business Week*.

I also recently read an interesting article on experiments with animals which have been oriented away from the Earth's magnetic field, with some startling results to their development even with as little as five degrees off the north-south axis.

Getting back to Ross, he's right about the press—a distressingly high percentage of reporters are woefully uneducated. This put me in mind of the hams who meet me and start out by saying, "Well, I don't always agree

Continued on page 68

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TH-75A

2m/70cm Dual Band HT

The new TH-75A Dual Band HT from Kenwood is here now! Many of the award-winning features in our dual band mobile transceivers are designed into one hand-held package.

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- **Super easy-to-use!** For example, to recall memory channel, just push the channel number!
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- **Automatic Band Change (ABC).** Automatically switches between main and sub band when signal is present.
- **Automatic offset selection on 2 meters.**
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- **Automatic battery saver circuit extends battery life.**

DUAL BAND HT
KENWOOD
TH-75A
144 440 FM DUAL BANDER

- **Supplied accessories:** Dual band rubber-flex antenna, PB-6 battery pack, wall charger, belt hook, wrist strap, water resistant dust caps.

Optional Accessories

• **PB-5** 7.2 V, 200 mAh NiCd pack for 1.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack • **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger • **BC-11** Rapid charger • **BT-6** 6-cell AA battery case • **DC-1/PG-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-22 and SC-23** Soft case • **SMC-30/31** Speaker mics. • **WR-1** Water resistant bag.

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Number 3 on your Feedback card

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Double Dayton

Japan Ham-Fair '89 turned out to be one of the largest amateur radio gatherings ever held. Approximately 58,000 attendees from 14 nations visited this massive ham convention, held August 25–27 at the New Hall of the International Trade Center in Tokyo, Japan. The list of dignitaries included IARU President Richard Baldwin W1RU and Chinese Radio Sports Association Vice-President Cheng Ping BZ1CP.

SP Now Mobile

Polish amateurs are now allowed to operate mobile, it was announced at the recent SP DX Convention in Warsaw. Eventually, mobile operation will be a normal part of SP licensing procedures, but right now Polish hams must have a license endorsement to use the new privileges. Packet is also expected soon, with a new SP Packet organization officially formed during the DX gathering.

OSCAR 13 Suffers Second Hit

OSCAR 13 was again put off-limits to general ham use on October 29. AMSAT-DL in Germany sent an urgent notice to all satellite users that apparently solar radiation has again corrupted the Internal Housekeeping Computer on the satellite. A-O-13 had the same problem a few weeks ago and was down for almost a week. Graham Ratcliff VK5AGR in Australia will attempt to re-start the computer. He will keep everyone posted on the condition of the bird.

In a related matter, Ross Forbes WB6GFJ of Project OSCAR informs us that the North American DCE Gateway now functions on incoming traffic only. Some of the gear was destroyed during the recent San Francisco earthquake. The equipment will soon be replaced.

Autopatch Phone Rates

California hams who own autopatch repeaters may soon be getting a welcome surprise from Pacific Telephone. Word is that the company will soon change the service for amateur autopatches from commercial rates to residential rates. The exact date for the change is unknown, and it applies to Pacific Telephone customers only. If your autopatch is on General Telephone, you will have to wait a while longer to see how they respond to the Pac Tel policy change.

VE-land Changes

Canada should have its revised amateur radio licensing structure in place within a year. All indications are that things are on schedule with the DOC Regulations. The syllabus and question banks are expected to be ready in March of 1990. The new regulations will be promulgated for several months before implementation of the restructured Canadian Amateur Service takes effect in September.

Micronesia

On October 12, the United States and the Federated States of Micronesia (V63) entered into a Third Party traffic agreement covering amateur radio. The agreement permits hams in both nations to relay personal messages on behalf of the citizenry. In addition, the agreement stipulates that when public telecommunications are not available, as in a disaster, communications relating to the safety of life and property may be handled by amateur operators in the two countries. Commercial messages are prohibited.

Brando

One of the nation's leading authors is looking to ham radio for help in his next book. Peter Manso is the author of *Mailer, His Life and Times* and other bestsellers. Manso has won countless awards for his work, and now he has undertaken to write about one of the world's best known actors, Marlon Brando.

Brando, an amateur radio operator, held several callsigns over the years, including WA6RBU and FO0GJ. If you have ever worked Brando under any of his many callsigns, and if you have a vivid recollection of the contact, Peter Manso would like to hear from you. Write him at PO Box 668, Truro MA 02666. Also, see the classified ads in the November issue of *QST*, page 180, for more information.

Instant Track Delayed

Deliveries of the new Instant Track program information from Project OSCAR were scheduled to begin on 1 November, but they've been delayed. If you ordered it before that date, you will eventually receive a flyer with information about the program. They were assembling the mailing in Los Altos Hills, California, on the day the area was hit by the 7.1 magnitude earthquake. Shipment is now being resumed.

Attention All Parents, Teachers and Students

The nominating period is now open for the 1990 *Westlink Report* Young Ham of the Year. The award, widely supported by industry, is given annually to a radio amateur, 18 years of age or younger, who best epitomizes the accomplishments of youth in amateur radio as related to community and amateur radio service on a local, regional, or national level; promotion of international goodwill through amateur radio; promotion of high ethical and moral values through amateur radio; education through and/or with amateur radio, or any combination of the foregoing.

To qualify, a candidate must hold a valid FCC Novice class or higher amateur license, be a resident of the United States, and attend an accredited learning institution. Letters of nomination are due no later than 1 May 1990 and must be detailed, accurate, and contain substantiating data to any and all claims made. The 1990 award presentation will take place at the ARRL National Convention in Kansas City in June 1990. Send nominations and substantiating documentation to 1990 Young Ham of the Year Award, *The Westlink Report*, 28197 Robin Avenue, Saugus CA 91350.

Fuji Off Line

The Japan Amateur Radio League (JARL) has announced termination of the operation of Amateur Satellite JAS-1/FUJI-OSCAR 12 effective November 5 because of low power generation.

Japan plans to launch its second amateur satellite, JAS-1B, in February 1990. To help publicize the event, the JARL recently placed special events station 8J6JSB into operation on all of the HF bands. It's operational from 1400–2000 UTC weekdays, 1400–2200 UTC on Saturdays, and 1000–2200 on Sundays and holidays.

Extra Quake Activity

WD6BPT at the St. Judes Hospital and Rehabilitation Center in Fullerton, California, was activated following last month's Northern California earthquake. The station came on at the request of the National Disaster Medical System. Manning the station, WA6OPS and N6FSL spent a day obtaining the status of hospitals in the affected area for the NDMS coordination center in Minnesota and the national headquarters of the Red Cross.

Out of Data

Zenith has dumped out of the PC market. The last of the truly "domestic" US manufacturers of home electronics has quieted speculation that it was backing out of the consumer market by selling its computer division to the Groupe Bull of France. The company says it will now concentrate on home entertainment and allied markets.

Thanx . . .

. . . to all those who contributed to this month's QRX. They are: *Westlink Report*, JARL, AMSAT-NA, CRRL, ARRL, GB2RS, JRRL, Telex, and Broadcast Television Magazine. Keep your photos and news items rolling into QRX!

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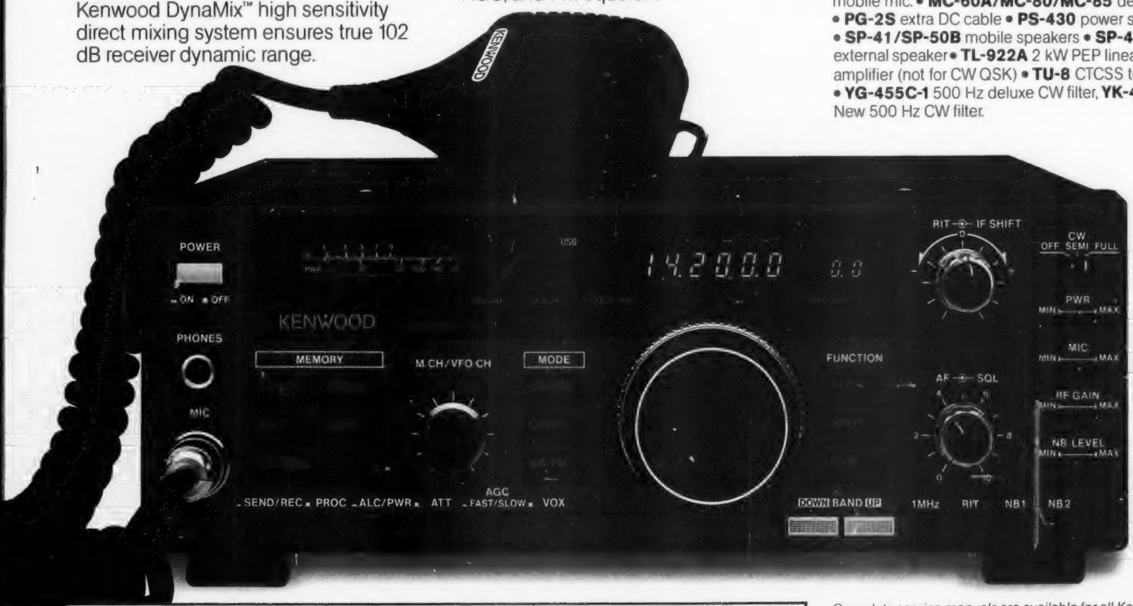

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All-mode multi-bander

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- Extended 6m receiver frequency range 45 MHz to 60 MHz. Specs. guaranteed from 50 to 54 MHz.
- Same functions of the TS-140S except optional VOX (VOX-4 required for VOX operation).
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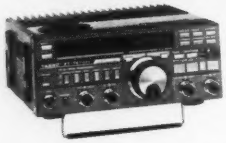

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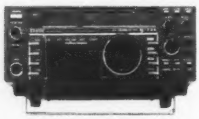

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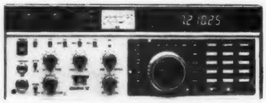

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155BAS: 5-el, 15 M. beam
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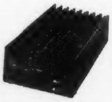

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CIRCLE 171 ON READER SERVICE CARD

The King and Us

King Hussein VE6JY1 and the royal family visit Alberta, Canada.

by Ken McGregor and Victor Post VE6VIP

When Victor Post VE6VIP heard that King Hussein JY1 was on his way to Alberta, he quickly got a group of Canadian hams together to organize a welcoming reception, with the approval of the Chief of Protocol and the Premier of Alberta. At VE6VIP's request, Ray Flat, regional director of Communications Canada in Edmonton, assigned the king the Canadian callsign VE6/JY1.

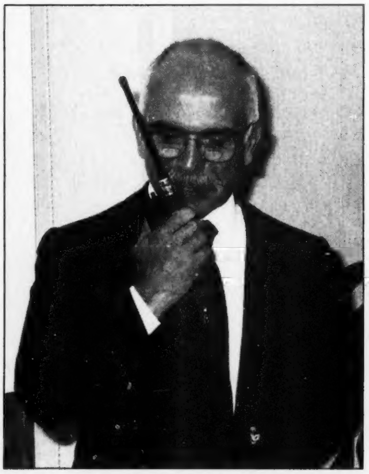

Photo A. King Hussein VE6/JY1 tries out his new FT-411.

VE6VIP, Norm Waltho VE6VW, and others, contacted local amateurs who could attend the reception. Soon they had invitations and name tags printed up, accommodations reserved at the Palliser Hotel in Calgary, and a buffet arranged for the reception. VE6VIP made and framed a 11″ x 14″ QSL print of Morraine Lake, superimposed with the king's call letters, then made 8″ x 10″ copies for attendees of the reception.

Roll Out the Red Carpet

King Hussein arrived on October 13, 1989. Victor VE6VIP, official photographer for royal tours, drove his car throughout the tour with his Kenwood TS-440S at the king's disposal. When the king, queen, and prince went for a walk at Lake Louise, the king took advantage of VE6VIP's mobile unit. Len Kochan VE6LEN, net controller in Edmonton, had a pile-up as soon as the king said "73" into the microphone. Amateurs from all over the country tried to catch a word with him. At this time, the king operated under Post's callsign and his Jordanian callsign.

Two days later, King Hussein attended the reception held in his honor. He shook the hand of every amateur who attended. Paul Neufeld, Calgary regional director of Communications Canada, presented the king with the framed permit, giving him the callsign VE6/JY1. Victor Post VE6VIP then presented the king with his framed QSL card and the Yaesu handheld, contributed by the local hams and Alfa Communications. As King Hussein received the HT, VE6PA's voice came over the speaker, welcoming him to the air, using his new Canadian callsign.

After takeoff, King Hussein QSOed Canadian hams on 20 meter USB.

King Hussein's visit did more to rejuvenate local interest in amateur radio than any other event in recent history. VE6VIP and the amateurs of Alberta thank His Majesty, King Hussein VE6/JY1, for his participation in the reception, and for publicly affirming his interest in amateur radio.

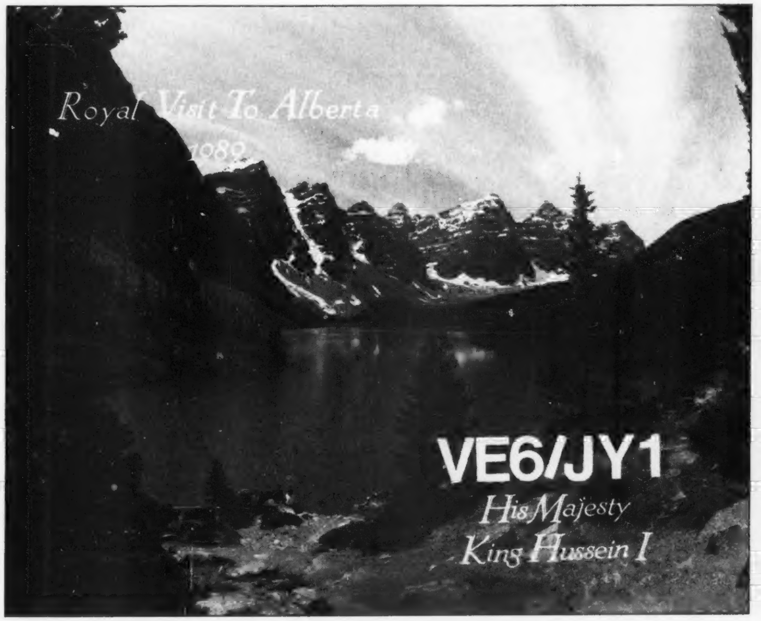

Photo B. Victor Post VE6VIP's memorable QSL to King Hussein.

Poor Man's Service Monitor

FM experimeters take note!

by William D. Crowl N6MWS

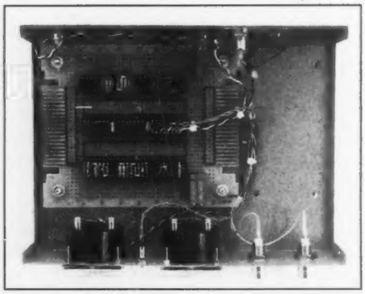

Photo A. Inside details of the Poor Man's Service Monitor. Note the clean modular layout.

A communications service monitor? For those of you not familiar with this device, it is the stock-in-trade test instrument for commercial radio service technicians, and I'm fortunate enough to have access to one at work. The most complete monitor includes a precision RF generator with an output attenuator, a spectrum analyzer, an oscilloscope, a well-instrumented scanning receiver, and a wattmeter, all in one portable instrument hardly larger than an ordinary oscilloscope.

A service monitor is also extremely expensive, and it's rare for the average amateur club, let alone the individual amateur, to have access to one. Even in my case, access is limited, and I never have as much time with the instrument as I would like. Therefore, I built the Poor Man's Service Monitor.

Practical Uses

While I knew that the precision RF generator and spectrum analyzer were beyond my home-brew skills and budget, the well-instrumented scanning receiver wasn't. I already had an oscilloscope, a frequency counter, and a wide coverage scanner. Using a few op amps and a pair of analog panel meters, I decided it should be possible to build the frequency error and deviation meters the professional service technician uses to set up the transmitters he services.

This device, together with an oscilloscope and a frequency counter, will allow you to make all kinds of radio system tests that ordinarily are beyond the capabilities of most amateurs. By connecting a counter on the Demod Tone output, you can easily see if your tone encoder is on frequency. An oscilloscope connected to the Demod Audio output will allow you to view the actual recovered audio before the audio processing circuits in the scanner get in the way. If you're curious about how digital paging works or what that funny racket you hear on some obscure frequency is, this is the tool for the job. Likewise if you want to add a DTMF or subaudible tone encoder to an older radio, but were afraid to try because you couldn't test it.

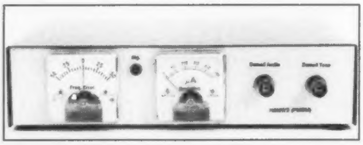

Photo B. Front panel of the Poor Man's Service Monitor. The optimum full-scale ranges for the Frequency Error and Deviation meters are 10 kHz (5 kHz of either side of center frequency), and 0–6 kHz, respectively.

FM packeteers can also use this tester to optimize the audio level output from the TNC going to the transceiver, usually adjustable by a trim-pot on the TNC. If this drive is too low, the signal deviation is unnecessarily low, reducing throughput. If the TNC drive to the rig is too high, the deviation will either exceed the legal channel limits and interfere with adjacent channels, or the rig's limiter will distort the overdeviated signal, also reducing throughput. The mark and space deviation should not exceed 3½ kHz.

Repeater owners will also find this useful for similar reasons—to maximize the NBFM voice signal deviation without going out of channel, and ensure that the signal is centered right on frequency. In fact, any ham who transmits on FM, such as HT and mobile ops, can use this tester to maximize their output signal and make sure that signal is properly centered.

Circuit Description

After considerable experimentation, I came up with the circuit shown in Figure 1. While this device is certainly no complete service monitor, it goes a long way toward giving the average amateur an idea of what is going on with his rig or any other transmitter he cares to listen to on the air.

Since 99% of the circuitry was already there, I included a remote control stop/start signal for a tape recorder. This output allows you to eliminate the dead air you would ordinarily hear during a net or preparedness drill recorded for later analysis.

In this project, I emphasize simplicity and low cost. After studying the output from the demodulator IC in my scanner, it became plain that the signals it produced weren't quite commercial test equipment quality—but are fine for the home experimenter.

This two-chip design uses the LM324 op amp IC because of its low cost and availability. In fact, I bought everything for this project, except the panel meters, at Radio Shack. (Two good construction aids are the *National*

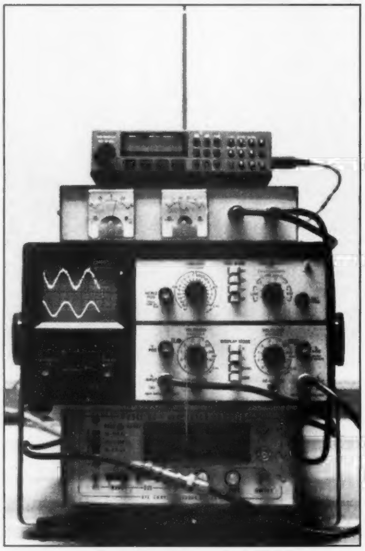

Photo C. From top to bottom: scanner, TPMSM, oscilloscope, and frequency counter. The Poor Man's Service Monitor is testing the output of the author's handheld. Note the DTMF signal on the oscilloscope (the HT feeds a dummy load).

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Tuned Input lets solid state rigs deliver full output

The Ameritron AL-80A uses a direct switched, 100% shielded pi-network tuned input circuit that provides an excellent load for any rig. Even the fussiest solid state transmitter works flawlessly with the AL-80A.

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A carefully designed Pi-L output tank using the optimum Q for each band gives you exceptionally smooth tuning, extremely wide range load impedance matching and full band coverage -- even on 160 and 80 meters -- *plus* you get an extra 10 to 15 dB of harmonic suppression.

You also get peak performance at different power levels from one end of the band to the other.

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3-500Z Tube in shielded RF compartment gives you nearly 70% efficiency

You get the rugged time proven 3-500Z tube with an estimated life of 20,000 hours ICAS. That's nearly 20 years operating 20 hours a week -- you may never have to replace your tube.

The AL-80A is built on a rugged steel chassis. It has a separate RF compartment that's fully shielded to keep unwanted RF from leaking out. This keeps RFI and TVI to an absolute minimum.

A superb RF design and layout, a Hi-Q tank circuit and commercially rated RF power components give you nearly 70% plate efficiency over the entire operating range. This puts maximum power into your antenna instead of heating up your amplifier.

A whisper quiet internal computer style fan draws in cool air over the power supply components and blows it around the 3-500Z tube. This removes excessive heat and gives you reliable performance.

Built-in adjustable ALC circuit keeps your exciter from overdriving your AL-80A. The result? A clean signal without flat-topping.

A standby switch prevents harmful thermal shock to your 3-500Z filaments by keeping them lighted when you're operating barefoot.

Gutsy Heavy Duty Power Supply

The guts of the AL-80A is its heavy ***heavy*** duty power supply.

A husky 22 pound power transformer using a high silicone steel core, computer grade filter capacitors totaling 26 ufd, heavy duty bleeders and ten 3 amp, 1000 V power rectifiers give a stiff 2700 volts fully loaded.

Some competing high priced amplifiers using *two* 3-500Zs *can't* give you much more power output than the AL-80A. Why? Because their lightweight power supplies can't deliver enough high voltage for the tubes.

Step-Start Inrush Protection™

When you first turn on your amplifier, a massive inrush current flows.

Your house lights flicker as you hear a loud "thump" from your amplifier. This terrible inrush current stresses *all* your power supply components to their limits. Your cold tube filament suffers abusive thermal shock.

Eventually, this massive inrush current will damage your amplifier.

The AL-80A special ***Step-Start Inrush Protection™*** *stops* damaging inrush current.

By starting your AL-80A through a 10 ohm current limiting resistor, then shorting the resistor with a relay, the AL-80A gives you a start up sequence that is ***easy*** on your tube and power supply components.

Don't consider a linear amplifier without this critical protection.

Multi-Voltage Primary protects your amplifier and gives you peak performance

Too high a line voltage stresses components and causes them to wear out and fail. Too low line voltage causes a "soft-tube" effect -- low output and signal distortion.

The Multi-Voltage Primary in the AL-80A transformer lets you compensate for too high or too low line voltage.

With the AL-80A you get the longest component life and peak operating efficiency -- regardless of your line voltage.

Before you buy an amplifier make sure it has a multi-voltage primary.

Dual Illuminated Meters

Two large meters give you a complete picture of the operating condition of your AL-80A. They let you know right away if there is a problem.

Grid current of the 3-500Z is monitored continuously by one meter. Grid Current indicates proper amplifier operation better than any other parameter.

You also get a multi-meter that measures plate voltage, plate current, ***peak*** RF watts output and drive power/ALC detector voltage.

Comes completely factory built, tested and guaranteed to work . . . *. . . not a kit you have to build*

You get a full kilowatt right out of the box -- ready to plug in and bust through QRM in minutes.

A kit could actually end up costing you more than your best price on the AL-80A -- and leave you frustrated if you can't get it to work.

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Two Year Warranty: Twice the protection of our nearest competitor

No other kilowatt amplifier on the market comes with a 2 year warranty. In the unlikely event that there are defects in materials or workmanship, we'll fix it free for 2 years from the date of purchase.

The 3-500Z is covered by the tube manufacturer's warranty.

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Even after the 2 year warranty period, Ameritron Customer Service Technicians are available to help you keep your AL-80A performing flawlessly -- no matter how long you have it. Just call 419-531-3024.

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Bust through QRM with a full kilowatt from the Ameritron AL-80A -- right out of the box. Call your favorite dealer for your *best* price and order today!

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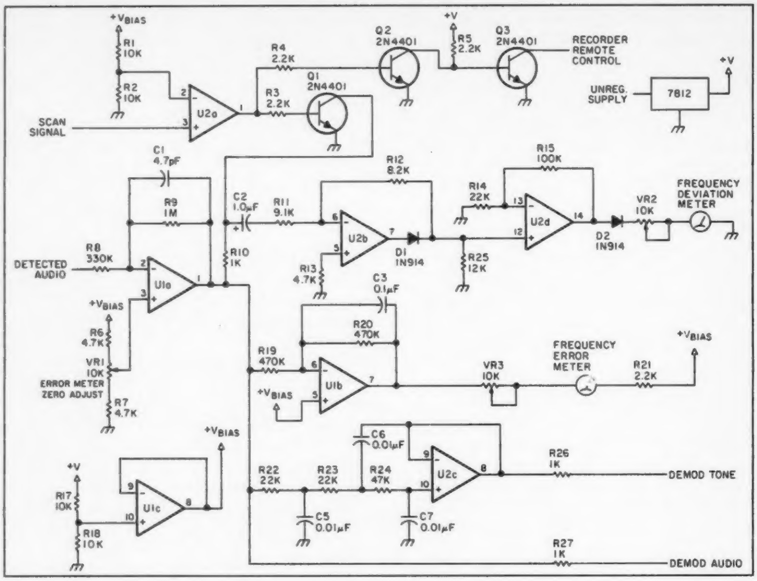
+VBIAS
R1 10K
R2 10K
SCAN SIGNAL
U2a
R4 2.2K
R3 2.2K
Q1 2N4401
Q2 2N4401
+V
R5 2.2K
Q3 2N4401
RECORDER REMOTE CONTROL
+V
UNREG. SUPPLY
7812
C1 4.7pF
R9 1M
R8 330K
DETECTED AUDIO
U1a
+VBIAS
R6 4.7K
VR1 10K
ERROR METER ZERO ADJUST
R7 4.7K
C2 1.0µF
R10 1K
R11 9.1K
R12 8.2K
U2b
R13 4.7K
D1 1N914
R25 12K
R14 22K
R15 100K
U2d
D2 1N914
VR2 10K
FREQUENCY DEVIATION METER
C3 0.1µF
R20 470K
R19 470K
U1b
+VBIAS
VR3 10K
FREQUENCY ERROR METER
R21 2.2K
+VBIAS
+V
R17 10K
R18 10K
U1c
+VBIAS
C6 0.01µF
R22 22K
R23 22K
R24 47K
U2c
C5 0.01µF
C7 0.01µF
R26 1K
DEMOD TONE
R27 1K
DEMOD AUDIO

Figure 1. Schematic of the Poor Man's Service Monitor.

Semiconductor Linear Databook and *Electronic Design With Off-The-Shelf Integrated Circuits*, by Meikin and Thackray.)

I found the meters at a local electronics junk shop. The best meters have a full scale deflection current of between 100 µA and 1 mA. Meters with current ratings outside of that range have high current requirements or problems with response speed.

The details of the actual circuit are pretty simple. U1A, a buffer amplifier, establishes the proper DC offset for the rest of the downstream amplifiers. It is also a first order low-pass active filter with an fc (corner frequency) of about 400 kHz. (All frequencies above the corner frequency are attenuated by the filter; all those below the fc are left unattenuated.) The gain of this stage was based on the performance of Motorola's MC3359 narrowband FM demodulator IC. (See the Motorola Data Sheet for the MC3357 and MC3359 ICs.) This chip produces a 0.3V DC output signal per kHz of signal deviation. Since I wanted to see more than 5 kHz of deviation, the maximum gain with a 12V DC supply was limited to three times the input signal.

U1B is also a low-pass active filter, but its fc is so low it might as well be DC, and that is, in fact, what its application is here. The output of U1B, a DC signal, directly tracks the average DC output of the demodulator IC. If the carrier signal goes higher (or lower) than the desired frequency, the DC output of U1B does also.

This signal is referenced to a bias signal generated by U1C. The frequency error meter will move to the left or right of center if the transmitter frequency is not centered on the selected channel. Use VR1 to zero adjust the frequency error meter and VR3 to calibrate full scale deflection.

U2C is a third order, low-pass active filter with an fc of about 350 Hz. The output of this filter is used to monitor subaudible or (CTCSS) tone signaling. This is very handy for tuning and testing subaudible tone encoders (see sidebar). You can connect either a frequency counter or an oscilloscope to this output.

U2A, a comparator, buffers the scan signal from the demodulator IC. This signal causes Q1 to shunt the audio from U1A to ground through current limiting resistor R10 when the receiver squelches. If this weren't done, the frequency deviation meter would be hammered against the stop whenever carrier was not present.

Deviation Meter Driver Circuitry

U2B is a simplified, active full-wave rectifier. This circuit has the advantage of eliminating the 0.6V forward drop characteristic of silicon rectifiers. When a positive voltage is present at U2-6, it passes around the amplifier to U2-12. U2B amplifies and inverts a negative voltage and also passes it along to U2-12.

To keep the positive and negative peaks the same amplitude, the choice of resistor values for R10, R11, R12, and R25 are critical. Don't make any substitutions unless you know what you are doing. This change in output impedance between positive and inverted negative voltage peaks means that U2D must buffer and amplify the rectified modulation signal to a level that will drive a meter movement.

Diode D2 provides 0.6V of "quiet" offset in the modulation meter signal. If the received signal is just a little noisy, the voltage drop across this diode will prevent the meter from interpreting the noise as modulation. Calibrate the frequency deviation meter with VR2.

Recorder Remote Circuitry

Transistor Q2, an inverter, gives Q3 the proper polarity for operating a tape recorder

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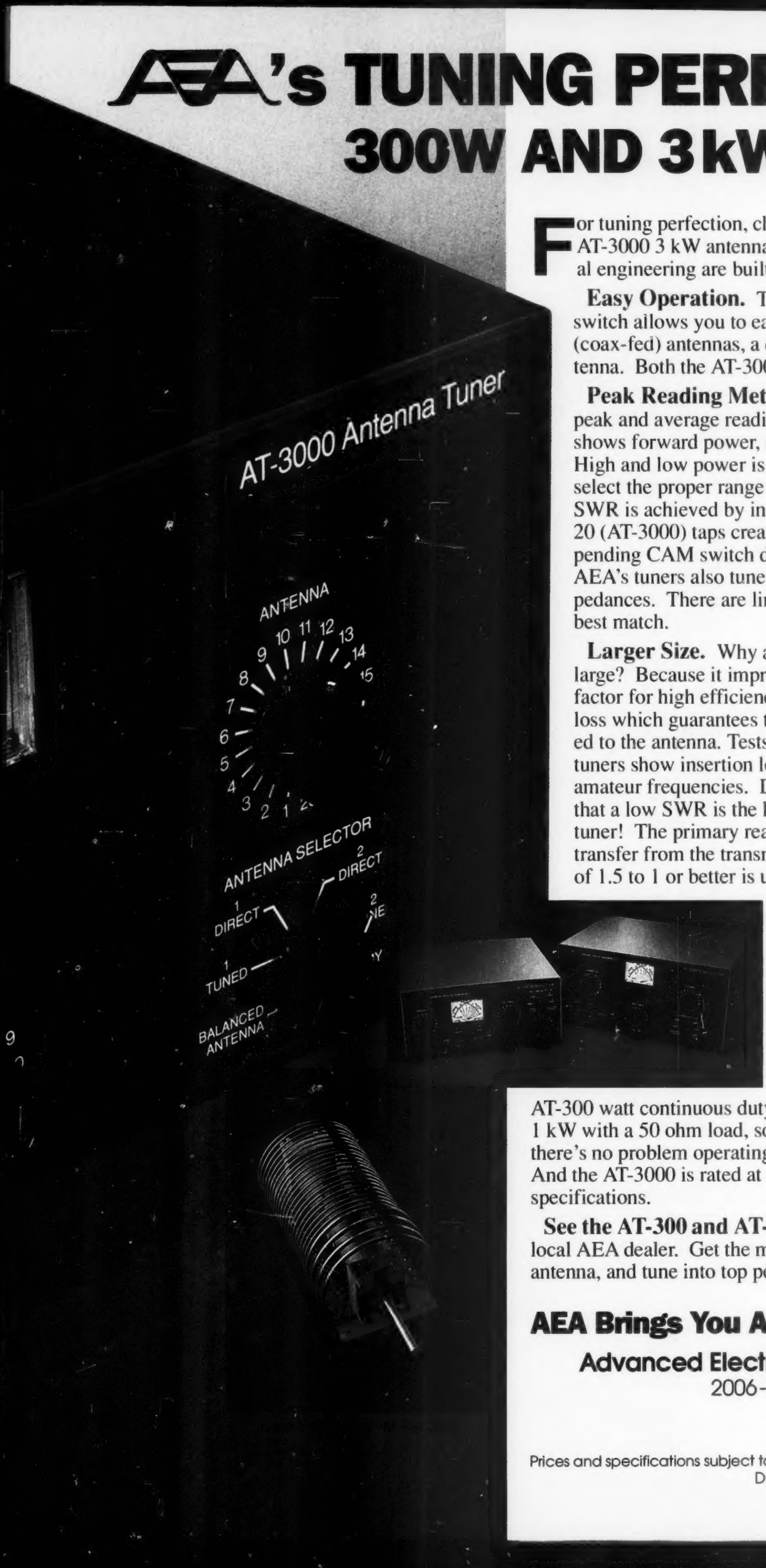

For tuning perfection, choose AEA's AT-300 300 watt or AT-3000 3 kW antenna tuners. Quality and exceptional engineering are built-in for maximum performance.

Easy Operation. The built-in front panel antenna switch allows you to easily select two unbalanced (coax-fed) antennas, a dummy load or a balanced antenna. Both the AT-300 and AT-3000 are easy to use.

Peak Reading Meter. The AT-3000 features a peak and average reading cross-needle meter which shows forward power, reflected power and SWR. High and low power is selected from the front panel to select the proper range for the SWR meter. Minimal SWR is achieved by inductors with 18 (AT-300) and 20 (AT-3000) taps created by AEA's exclusive patent pending CAM switch design for accurate tuning. AEA's tuners also tune a wider range of antenna impedances. There are limitless possibilities to create the best match.

Larger Size. Why are the AT-300 and AT-3000 so large? Because it improves the inductors' Q (quality) factor for high efficiency. High Q means low insertion loss which guarantees that maximum power is delivered to the antenna. Tests with some roller coil antenna tuners show insertion loss as high as 20dB on some amateur frequencies. Don't be fooled into believing that a low SWR is the key reason for using an antenna tuner! The primary reason is for maximum power transfer from the transmitter to the antenna. An SWR of 1.5 to 1 or better is usually all that is necessary to "make the transmitter happy." Remember that you can get 1 to 1 SWR with just a dummy load. AEA's two coil design also provides harmonic reduction, maximum power transfer and a wider range of impedance matches.

300 or 3,000 Watts. The AT-300 watt continuous duty cycle tuner has been tested at 1 kW with a 50 ohm load, so you can rest assured that there's no problem operating the AT-300 at 300 watts. And the AT-3000 is rated at 3 kW. AEA stands behind its specifications.

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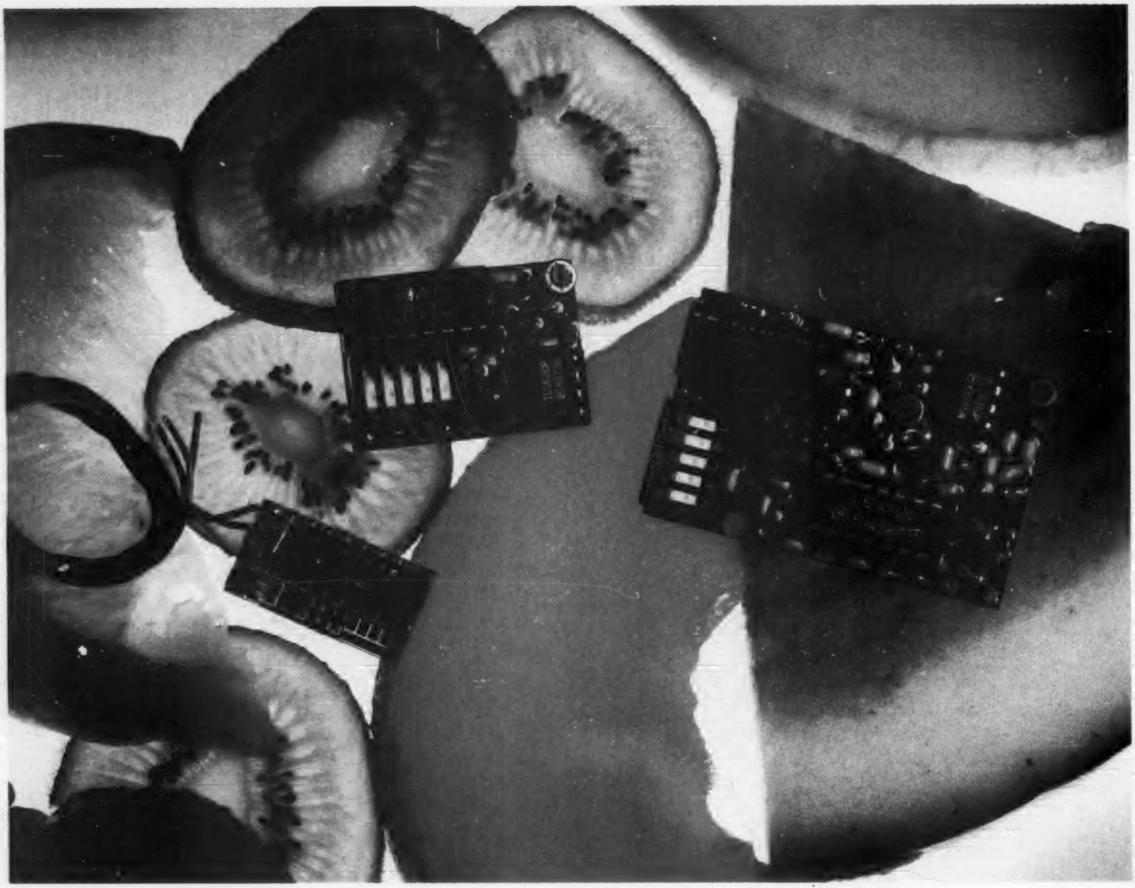
CIRCLE 65 ON READER SERVICE CARD



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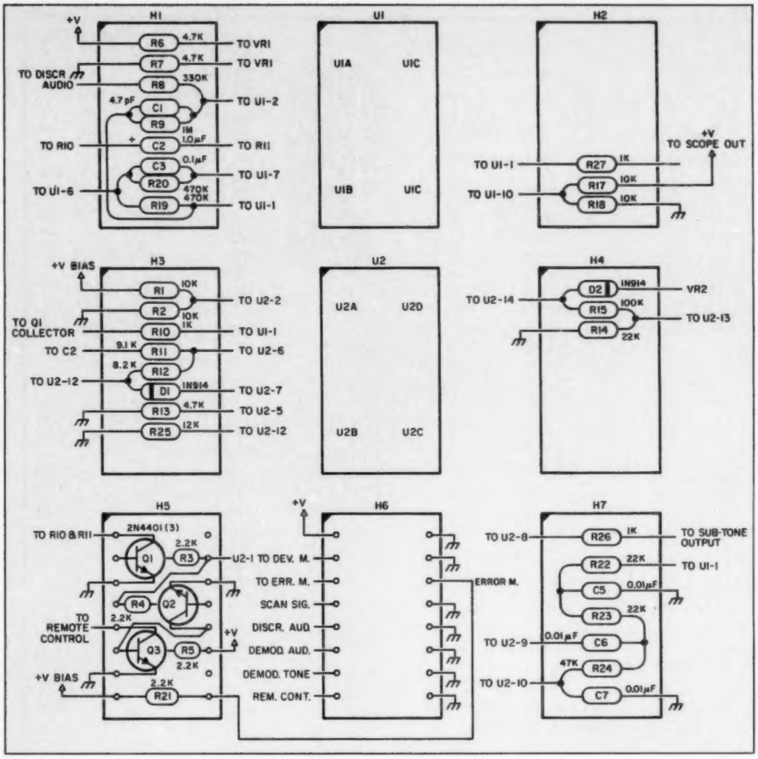
H1
+V
R6
4.7K
TO VRI
R7
4.7K
TO VRI
TO DISCR AUDIO
R8
330K
TO UI-2
4.7 pF
CI
R9
IM
TO RIO
+
C2
1.0µF
TO RII
C3
0.1µF
TO UI-7
R20
470K
TO UI-6
RI9
470K
TO UI-1
UI
UIA
UIC
UIB
UIC
H2
+V
TO SCOPE OUT
TO UI-I
R27
IK
TO UI-10
R17
10K
R18
10K
H3
+V BIAS
RI
10K
TO U2-2
R2
10K
TO QI COLLECTOR
RIO
IK
TO UI-I
TO C2
9.1 K
RII
TO U2-6
8.2 K
RI2
TO U2-12
DI
IN914
TO U2-7
RI3
4.7K
TO U2-5
R25
12K
TO U2-12
U2
U2A
U2D
U2B
U2C
H4
D2
IN914
VR2
TO U2-14
RI5
100K
TO U2-13
RI4
22K
H5
2N4401(3)
TO RIO & RII
QI
2.2K
R3
U2-I TO DEV. M.
R4
Q2
TO REMOTE CONTROL
2.2K
Q3
R5
2.2K
+V
+V BIAS
2.2K
R21
+V
H6
TO ERR. M.
SCAN SIG.
DISCR. AUD.
DEMOD. AUD.
DEMOD. TONE
REM. CONT.
ERROR M.
H7
TO U2-8
R26
IK
TO SUB-TONE OUTPUT
R22
22K
TO UI-I
C5
0.01µF
R23
22K
TO U2-9
0.01µF
C6
47K
R24
TO U2-10
C7
0.01µF

Figure 2. Parts placement for the Monitor.

remote control input. When Q3 is conducting, the tape recorder will record. When it's open, the tape recorder will stop. This part of the circuit was a "gimmie"; almost all of the circuitry required to implement it was already there. If you have no use for this circuit, feel free to eliminate Q2, Q3, and associated resistors.

Construction

First evaluate the scanner you want to use as your test receiver. Almost all currently produced low cost narrowband FM receivers use the Motorola MC3357 or MC3359 IC for the low IF and demodulator circuit. Occasionally it's hard to identify this IC since the part number is disguised by Oriental manufacturers. Usually the 3357 or 3359 will be a portion of the part number even if the MC is not. In extreme cases you may have to either compare the pinout from the Motorola data sheet to the schematic of your scanner, or look for a 455 kHz ceramic filter near a likely IC, to find the right device. If your scanner has the Motorola IC or a foreign made clone, you don't even need a schematic of your scanner to do this project. You need only to bring three signals from the scanner, and all three are available on the demodulator chip. If you have the MC3357 (16-pin) chip, the Ground, Scan, and Audio are pins 15, 13, and 9, respectively. For the MC3359 (18-pin) IC, these pins are i7, 15, and 10.

I brought all three signals out of my scanner with a ⅛" stereo jack and built a cable to connect the test set to the scanner. This left the scanner free for other uses when not used as a test receiver. It's best to connect the receive audio to the tip, scan signal to the ring, and ground to the shank. Make the connection to the scanner only with power off, to prevent damage from the momentary short that will occur when you plug in the test set.

Modular Convenience

I built my prototype on a small card for digital projects and mounted all my parts on headers. (A header is a pin platform that inserts into an IC socket to allow components to be easily mounted to that socket.) I highly recommend this approach for two reasons. First, if you use the interleaved power and ground traces that pass down the middle of each IC pin pattern, you can make solder bridges for power and ground connections. If you make all the power and ground connections before you wire the circuit, you'll have a neat, easy-to-troubleshoot device with very low impedance power and ground connections. This helps a lot with noise immunity, something to consider with a transmitter operating nearby. (Don't forget to include a couple of 0.01 µF power-to-ground bypass capacitors, too.)

Second, mounting the parts on headers makes the project modular and easier to construct over a period of time. You can build each module in an evening, after the kids go to bed, without leaving anything hanging.

Not shown on the schematic are the power

Continued on page 77

Parts List for the Poor Man's Service Monitor

Qty.	Description	Part Number	Desig.	Price Ea.	Ext. Price
2	LM 324 Quad Op-Amp IC	276-1711	U1-U2	1.29	2.58
1	7812 12vdc 3 terminal reg.	276-1771		1.19	1.19
3	2N4401 NPN transistor (TO-92)	276-2058	Q1-Q3	.49	.98
2	1N914 small signal diode	276-1122	D1-D2	.94	.94
3	10kΩ 15 turn potentiometer	*271-343	VR1-VR3	1.49	4.47
4	10kΩ 5% CF resistor	271-1335	R1-R2,R17-R18	.39	.39
4	2.2kΩ 5% CF resistor	271-1325	R3-R5,R21	.39	.39
3	1kΩ 5% CF resistor	271-1321	R10,R26,R27	.39	.39
1	330kΩ 5% CF resistor	*29SJ250val	R8	.08	.40
1	1MΩ 5% CF resistor	271-1356	R9	.39	.39
3	4.7kΩ 5% CF resistor	271-1330	R6-R7,R13	.39	.39
2	470kΩ 5% CF resistor	271-1354	R19,R20	.39	.39
3	22kΩ 5% CF resistor	271-1339	R14,R22-R23	.39	.39
1	100kΩ 5% CF resistor	271-1347	R15	.39	.39
1	9.1kΩ 5% CF resistor	*29SJ250val	R11	.08	.40
1	8.2kΩ 5% CF resistor	*29SJ250val	R12	.08	.40
1	12kΩ 5% CF resistor	*29SJ250val	R25	.08	.40
1	47kΩ 5% CF resistor	271-1342	R24	.39	.39
1	4.7 pF 50 WVDC cer. capacitor	272-120	C1	.39	.39
1	1.0 µF 35 WVDC tant. capacitor	272-1434	C2	.49	.49
3	0.01 µF 50 WVDC capacitor	272-1065	C5-C7, Bypass	.59	1.18
1	Digital project perfboard	**JE403		9.95	9.95
1	Deluxe project box	270-272B		8.49	8.49
2	Panel mount BNC jack	278-105		1.39	2.78
2	Panel mount ⅛" stereo jack	274-250		2.19	2.19
1	500–0–500 microammeter 3½"	*541-MS-DUA-5H5			17.00
1	0–10 milliammeter 3½"	*541-MS-DMA-010			16.00

Notes on parts list:

1. All part numbers refer to Radio Shack catalog part numbers unless otherwise specified.
2. * Indicates part available from Mouser Electronics, 1-800-346-6873.
3. ** Indicates part available from Jameco Electronics, 415-592-8097.

HF Equipment	Regular	SALE
IC-765 Xcvr/ps/keyer/auto tuner	3149.00	2699

IC-781 Xcvr/Rcvr/ps/tuner/scope	6149	5295

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	1469
PS-35 Internal power supply	219.00	199^{95}
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	109^{95}
FL-53A 250 Hz CW filter (2nd IF)	115.00	109^{95}
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	

IC-735 HF transceiver/SW rcvr/mic	1149.00	999^{95}
PS-55 External power supply	219.00	199^{95}
AT-150 Auto. antenna tuner ***(Special)***	445.00	369^{95}
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	
IC-725 Ultra compact HF xcvr/SW rcvr	949.00	829^{95}
IC-726 10-band xcvr/6m/.5-30MHz rx	1299.00	1129

Other Accessories	Regular	SALE
IC-2KL HF solid state amp w/ps	1999.00	1699
IC-4KL HF 1KW out s/s amp w/ps	6995.00	5995
EX-627 HF auto. ant. selector ***(Special)***	315.00	269^{95}
PS-15 20A external power supply	175.00	159^{95}
PS-30 Systems p/s w/cord, 6-pin plug	349.00	319^{95}
MB Mobile mount, 735/751A/761A	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
PP-1 Speaker/patch	179.00	164^{95}
SM-6 Desk microphone	47.95	
SM-8 Desk mic - two cables, Scan	89.00	
AT-100 100W 8-band auto. ant. tuner	445.00	389^{95}
AT-500 500W 9-band auto. ant. tuner	589.00	519^{95}
AH-2 8-band tuner w/mount & whip	758.00	689^{95}
AH-2A Antenna tuner system, only	559.00	499^{95}
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IC-275H 100w 2m FM/SSB/CW	1399.00	1199
IC-375A 25w 220 FM/SSB ***(Closeout)***	1399.00	799^{95}
IC-475A 25w 440 FM/SSB/CW w/ps	1399.00	1199
IC-475H 100w 440 FM/SSB/CW	1599.00	1369
IC-575A 25w 6/10m xcvr/ps ***(Special)***	1399.00	1129
IC-575H 25w 100w 6/10m xcvr	1699.00	1469

VHF/UHF/1.2GHz mobiles	Regular	Sale
IC-47A 25w 440 FM/TTP mic ***(Closeout)***	549.00	369^{95}
PS-45 Compact 8A power supply	145.00	134^{95}
UT-16/Ex-388 Voice synthesizer	34.99	
SP-10 Slim-line external speaker	35.99	
IC-28A 25w 2m FM, TTP mic	499.00	439^{95}
IC-28H 45w 2m FM, TTP mic ***(Special)***	469.00	379^{95}
IC-48A 25w 440-450 FM, TTP mic	509.00	449^{95}
HM-14 Extra TTP microphone	59.00	
UT-28 Digital code squelch	39.50	
UT-29 Tone squelch decoder	39.50	
HM-16 Speaker/microphone	34.00	
IC-228A 25w 2m FM/TTP mic ***(Special)***	509.00	419^{95}
IC-228H 45w 2m FM/TTP scan	539.00	479^{95}
IC-448A 25w 440 FM/TTP mic	599.00	519^{95}
UT-40 Pocket beep function	45.00	
IC-900A Transceiver controller	639.00	499^{95}

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UX-29A 2m, 25w band unit	299.00	269^{95}
UX-29H 2m, 45w band unit	349.00	319^{95}
UX-39A 220MHZ, 25w band unit	349.00	299^{95}
UX-59A 6m, 10w band unit	349.00	319^{95}
UX-129A 1.2GHz 10w band unit	549.00	499^{95}
IC-901 Fiber Optic 2m/440 xcvr	1199.00	1049
IC-1200A 10w, 1.2GHz FM ***(Closeout)***	699.00	599^{95}
IC-2500A 35w, 440/1.2GHz FM mobile	999.00	869^{95}
IC-3210A 25w, 2m/440 FM/TTP	739.00	639^{95}
IC-2400A 45w 2m/35w 440 FM/TTP	899.00	789^{95}
AH-32 2m/440 Dual Band mobile ant	39.00	
AHB-32 Trunk-lip mount	39.00	
Larsen PO-K Roof mount	23.00	
Larsen PO-TLM Trunk-lip mount	24.70	
Larsen PO-MM Magnetic mount	28.75	
RP-1510 2m 25w repeater	1849.00	1649
RP-2210 220MHz 25w rptr ***(Special)***	1649.00	1399

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IC-2AT 2m/TTP***(Close)***	319.00	279^{95}
IC-02AT/High Power	409.00	349^{95}
IC-04AT 440 ***(Closeout)***	449.00	369^{95}
IC-2SA 2m HT	419.00	369^{95}
IC-2SAT 2m HT/TTP	439.00	389^{95}
IC-3SAT 220 HT/TTP	449.00	399^{95}
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HAM PROFILES

There are no "average" hams!

Mary Seferaj KB2IGY.

Tune In To "Iggy"

Mary Seferaj KB2IGY, 13 years old, is in the 8th grade at Intermediate School 72 in Staten Island, New York. Mary visits the ham radio classes of Carole Perry WB2MGP, her former teacher, to tell the youngsters in the program what fun they have to look forward to when they get their licenses.

Every morning at 7 a.m. Mary goes to the hamshack in WB2MGP's classroom to talk to her new friends on the 146.88 repeater and on the local 220 repeaters. The local hams have given her the nickname "Iggy" because they love to hear KB2IGY on the air each morning.

Mary is also a frequent operator in the "CQ All Schools Net" run by Gordon West WB6NOA and Carole Perry every Tuesday and Thursday at 17:30 UTC on 28.306 MHz. Joe N6CRX, one of the West Coast net controls, has often complimented Mary on her enthusiasm and her fine operating procedure. She is a great role model for the other students in the ham radio program.

Mary wants to be a pediatrician when she grows up. Right now, her other interests include playing soccer and bicycle racing.

Mega-Talented Ham

Six o'clock on Sunday mornings may find some folks still fast asleep, but devotees of hunting, fishing and camping in Illinois, Wisconsin, Indiana, and Michigan, will be found tuned to WCBR 92.7 on the radio dial, listening to the "Mike Jackson Outdoors Show." Not many of his listeners know that in addition to being an authority on saugers in the Kankakee River, walleyes in Petite Lake, grouse hunting and a myriad of other sporting facts, "Mike Jackson," (real name is Orrin Brand K9KEJ) is a man of many talents and trades.

Orrin got his first amateur radio license at age 12. While attending high school, he often demonstrated electronics and elementary amateur radio stations at science fairs. Orrin, who has his B.A. degree in journalism and communications, has been involved in radio, film, and theatre in many ways since the 60s, including stage and screen acting and comedy-writing, and as a radio announcer, news director and anchorman.

In 1973 he returned to Chicago to take over a family-owned printing business and at the same time started an advertising business. All during this period he wrote prolifically for outdoors publications. Since 1980 he has been in marketing and advertising with his own firm, Brand Communications, specializing in consumer and industrial accounts.

Orrin Brand K9KEJ.

Orrin loves to fly, and has flown aircraft within the Arctic Circle. He is also a professional photographer who exhibits and sells his own prints once or twice a year and voraciously reads three newspapers a day and two books a week.

Orrin has two daughters, Melissa and Stephanie, aged 19 and 21. He and his wife Charlotte and their seven-year-old daughter Debbie live in Buffalo Grove, Illinois. (Biography by Angelo Polvere KA9CSO.)

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

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The 1¼ Meter Serendipity Antenna

Gives its commercial brothers a run for their money.

by John M.C. Wilson KA1LCC

One rainy Saturday afternoon while I was practicing code, it occurred to me that it would be handy to have a 1¼ meter antenna for simplex operation around town. Since I live near Pack Monadnock mountain, atop which sits the central node for the New England 220 MHz Network, a rubber duck and 150 mW gets me into all six New England states and New York! In fact, I can copy the Pack repeater with no antenna at all! Simplex operation, however, was more conducive to leisurely rag-chews.

As usual, I was short of funds for radio projects, so I began to think about a home-built antenna. I suddenly remembered that there was an old Bearcat monitoring antenna in the attic that might be modified for my purpose. I stopped the code practice (not a difficult decision) and happily went to work on the project.

Favorable Features of the Bearcat

The monitoring antenna had the following qualities that made it suitable for the purpose: a very rugged base plate and mast clamp; very good quality aluminum tubing ground planes; and a whip antenna mounting, adjustable with a set screw. The tall plastic housing from which the whip protruded suggested a loading coil, as did the rather impressive 25 to 512 MHz coverage mentioned on the data sheet.

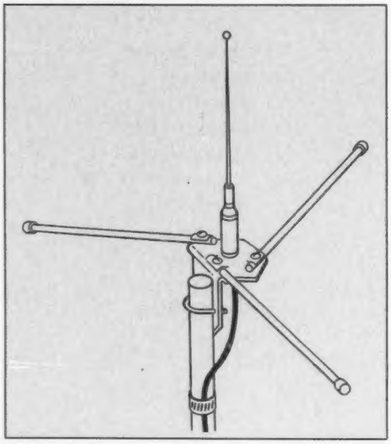

Figure 1. The Bearcat as a wideband monitoring antenna...

> "The construction project was a lot of fun and cost me nothing..."

The Mod

The first step was to remove the loading coil. Since the coil was cemented inside the plastic tube, I had to saw it open near one end. I then removed the coil, and soldered a short length of the coil wire to the connection coming out of the SO-239 type connector. I reassembled the now-shortened plastic tube and antenna holder, using press fitting and cement.

The whip antenna was next cut to 12⅝", but this measurement had to be taken from the bottom of the plastic support because there was nothing to prevent radiation from the short piece of wire taken from the old loading coil and other hardware.

With a tube cutter, I then trimmed the ground planes to 13⅛", and replaced their plastic ends. Next the tubes were squeezed between two steel rods in a vise and flattened near the mounting area. Bending them to 45 degrees was comparatively easy, and structurally they remained very strong.

The assembled antenna seemed very small in comparison to the one I started with, since most of the original was left on my workbench! I mounted it on several lengths of TV tubing and it seemed to work very well. When finally installed over the house at 40 feet above the ground, it covered all the local area as well as quieting a repeater 65 miles away. A friend generously loaned me an SWR/Power Meter, and to my surprise the SWR was 1.1:1 at mid-range in the frequency.

The construction project was a lot of fun and cost me nothing, so I call it the *serendipity* antenna.

Looks and Price Can Deceive

There is an unhappy ending to the story. Some time later I bought a very fine and impressive commercial antenna with a claimed 5.5 dB gain and mounted it in exactly the same position as the tiny ground plane. It would not cover all the local area and would not even trigger the repeater 65 miles away. Sadly I took it down and replaced it with my home-built, and explained to the XYL that I had blown a lot of money. Is there anyone out there who needs a commercial 1¼ meter antenna?

John M.C. Wilson KA1LCC is a recently retired aeronautical engineer. He became interested in two-way radio when a tank crew member in the Canadian army. John has been an amateur since 1983. His address is now RR 2, Box 368, Peterborough NH 03458.

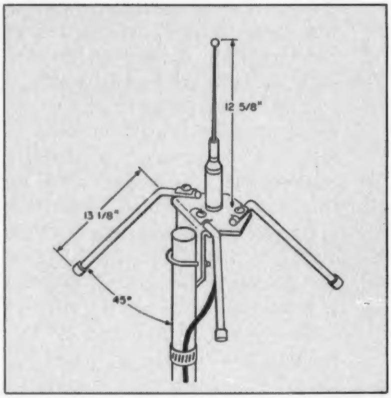

Figure 2.... and as a good-gain 1.25m antenna!

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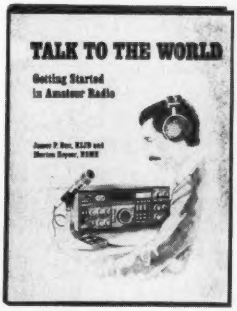
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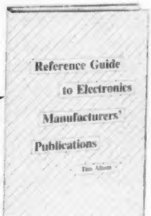
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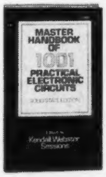
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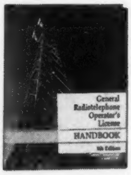
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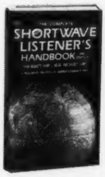
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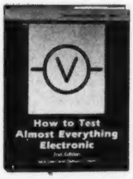
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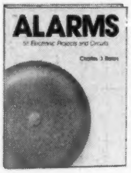

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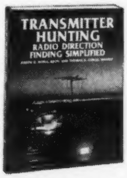
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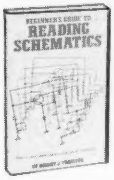
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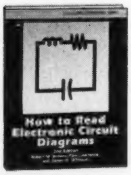
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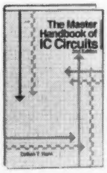
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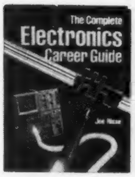
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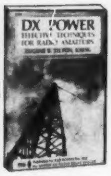

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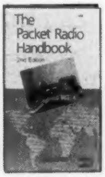
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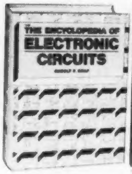
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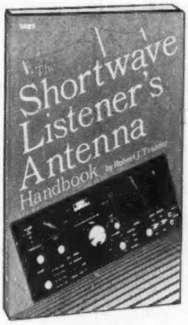
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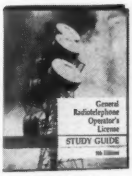
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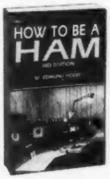
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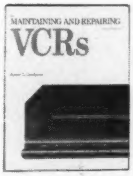
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73 Review

by Bill Mick K3RVN/G0EZZ

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Most of us have seen the kind of mobile ham radio installation that's safe to operate only when the vehicle is parked. You can use a radio that's mounted under the passenger's side of the dash, or in the glove box, or down near the floor, but it's hardly user-friendly. Keeping your head down for long periods of time while driving can be downright unhealthy!

We can blame the automakers for this. If they had more engineers and fewer stylists designing their dashboards, your car would come with a standardized equipment bay in the center of the dash. After all, automotive radio and stereo units already fit standard cutouts. Imagine the convenience of simply racking and stacking your ham rig, cellphone, FAX machine, navigation and countermeasures gear, ashtray, coffeemaker, or flowerpot, just the way you want them, under a sliding wood veneer cover. Perhaps the Japanese electronics companies will influence the Japanese car companies. In the meantime I, and a lot of other hams, want to operate mobile, and we want to operate safely and conveniently.

An Elegant Solution

Over the years, various radio manufacturers have brought out models with remote controls or detachable front panels. These radios don't go far enough to meet my desires: I wanted full, flexible 2m and 70cm coverage in a package that doesn't require two hands to operate and doesn't crowd the front seat. Besides, as a Yank who has spent a lot of time working in England, I have mobile rig requirements that are a bit more complicated than the average ham's. The ICOM IC-900 was pretty tempting until I worked out the actual cost and discovered that I would have to buy a 440 MHz unit for stateside use, and a separate 430 MHz unit for U.K. use.

Enter the Yaesu FT-4700RH. It covers the full 430–450 MHz range at 40 watts, in addition to 50 watts on 2m, and the front panel can be detached and mounted where I can reach it while driving. The radio has all the expected features: ten memories on each band, flexible scanning modes, and low power (5 watt) capability. Dual-band receive is standard, with a balance control that sets the relative audio levels from the two sources. Crossband duplex operation is also possible, and a single button toggles between two separate transmit sections. An arrow on the orange LCD display clearly indicates the selected band.

Photo A. Control head and main unit ready for installation. Note dummy front panel with remote connector.

Photo B. FT4700RH installation in British Sierra XR4x4. The control head can go almost anywhere, and a strip of Velcro™ lets you detach it quickly for security. The right angle mike connector is home-brewed.

The FT-4700RH has a high contrast display with big numbers and a two-level backlight. The dimmed display is easy to read during the day, unless it's in direct sunlight. It has a separate S-meter/output bar graph for each band, as well as offset, tone squelch, and "busy" indicators. Surrounding the display window are fifteen controls, mostly push-buttons.

If you've used an FT-23R or MK II FT-290R, you'll find the basic functions of the FT-4700RH fairly obvious. Some of the fancier features had me slavishly following the detailed key sequences on the supplied reference charts. Fortunately, after an evening setting up my preferred memories, offsets, and scan ranges, I can now activate most of the complex personalized programming very easily. I still keep a few photocopies of the reference sheets in the car for inevitable future reprogramming.

Impressive Engineering

The FT-4700RH is really two rigs in one box. The nominal 13.6 VDC feed is common to both bands, and the received audio from both radios goes through a single speaker circuit. There are two flying coaxial leads, with an N socket for 70cm, and an M (SO-239 or "UHF" type) socket for 2m. You can also get an optional duplexer that will let you use a single feedline and a dual-band antenna. The panel display is symmetric with the two bands. The BAND switch selects one as primary, and the other as secondary. When the primary band is 70cm, key presses trigger a high tone; on 2m they trigger a low beep. You can set the step size independently for each band (5, 10, 12.5, 20, or 25 kHz). Half of the memories, including the "call" channel, are fully programmable, with parameters like separate receive and transmit frequencies (for odd splits), and optional CTCSS tones. Other memories store simplex channel data, or repeater offsets, and four hold subband scan range boundaries. Unlike many older radios, this model lets you choose a frequency via a memory selection, tap a button, and tune from that memory as though already in dial mode.

My unit came with one tone squelch board. You'll need a second board for CTCSS on the second band. The LOW power switch is common to both transmitters, meaning that you can't run low power on one band and high power on the other. The main unit has a heat sink with an integral fan, and the manual makes a point about ensuring ample air flow for the fan, particularly when running full power. Five-minute 50 watt transmissions cause only slight heating, even under the car seat.

The connection between the front panel and the main box is a 10-foot shielded cable with a miniature six-pin data plug. This cable is fine for hiding the main box under the seat, but is on the short side for trunk mounting. If you wanted to build an extension, the hardest part would be finding connectors to match. Two of the conductors are grounded, one feeds regulated 9 volts to the front panel, and one carries amplified microphone audio. The fifth conductor brings speaker audio to the microphone connector for packet or speaker-mike use. This leaves one conductor for all the control functions, including PTT!

Smart Front Panel

The FT-4700RH is a very intelligent radio, and much of this resides in two large SMDs behind the front panel display. Multiplexing switch settings or memorized frequency values onto a bi-directional serial line isn't all that uncommon in modern ham equipment. However, you won't find a lot of gear that translates analog control settings (volume, squelch, and balance) onto a serial line as the FT-4700RH does. Call me old-fashioned, but for me the Yaesu's knobs are more natural than sliders or "up/down" switches, even if level changes sometimes seem stepped rather than smooth.

Yaesu supplies a dummy front panel to cover the hole left by removing the smart one. This has been sold as an option in the past, but was supplied as standard with my unit. You often don't need to separate the front panel from the rest of the rig—even left in one piece the FT-4700RH is very compact. If the front panel is mounted separately, count on fitting an external speaker, too, as audio that emanates from under the seat will not be very satisfying. Surprisingly, I found no trace of RF feedback on either band, even at high power settings.

Ideas for Improvement

The FT-4700RH is just a bit shy of perfect for me. There are a few things I wish Yaesu had done differently. For instance, the POWER switch is sprung softly; a firmer switch would prevent accidental turnoff when pushing the nearby LOW or DIM switches.

The BAND switch is too far away from the tuning knob; it should be where the LOW and DIM switches are located to allow band switching and tuning without excessive hand movement. Likewise, the D/MR (dial/memory) and CALL buttons should be closer to the knob. In my opinion, the DIM and LOW switches just don't get used enough to rate such big buttons. I look forward to the day when an owner will be able to customize his control panel by assigning functions to the buttons he finds most comfortable.

With the variety of step sizes provided, I was surprised that there is no 15 kHz step option. The set deals well with the normal British 25 kHz channelization, but when the next guy up the band is operating between channels, only 12.5 kHz away, there is some breakthrough. With 15 kHz spacing, the signal on the adjacent channel has to be way off frequency, or wildly over-deviating, to cause a problem on receive. The supplied microphone on the U.S. spec model had a DTMF pad and the usual "up/down" step switches; a band change switch on the mike would be a very useful addition.

My major gripe is a matter of convenience, aesthetics, and human engineering. Although the control head seems like a natural place to connect the microphone, and traditionally things have been done this way, I find it inconvenient because the mike cable obscures the forward view when the head is visor-mounted. In contrast, the IC-900/901 control heads have no microphone connector.

A second microphone jack on the main FT-4700RH box, or on an inline box on the remote cable, would simplify the microphone connection in many installations. I expect that I will build some sort of inline box eventually, although the job will be complicated by the fact that the front panel actually contains a few stages of microphone amplification. Furthermore, since the PTT function is activated by a digital code on the serial I/O line, and not a simple closure to ground, it will probably be necessary to hook up a logic analyzer in order to scope out the PTT code. If Yaesu really wants to capitalize on its design, it will market an interface box that permits external computer control in lieu of the front panel.

My FT-4700RH currently rides in a British Ford Sierra XR4x4, a close relative of the Merkur XR4RTI sedan imported into the US. Current versions of this model have a dashboard inset which houses a digital clock, and this space just happens to accommodate the control head, with the help of a couple of rubber feet and a strip of Velcro™. The installation looks good, and can be concealed quickly when necessary. The controls are within inches of the steering wheel, and the display is at the same height as the speedometer and tach. Only an aerospace heads-up display would be closer to the forward line of sight. The hand mike would be convenient to grab, too, except that U.K. law prohibits the use of such mikes in vehicles.

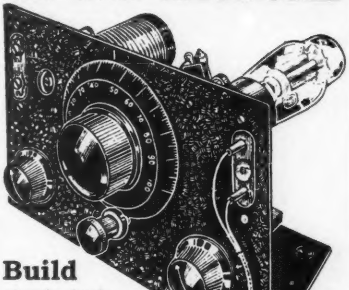
I use a small boom mike, with a PTT switch on the gearshift, and a cable that runs up to the mike jack on the control head. This results in a very unsightly loop of microphone cable jutting out from the middle of the dash. I scoured suppliers on both sides of the pond to find a low-profile right-angle eight-pin mike plug, found none, and was forced to fashion my own, using parts from other plugs. It dresses neatly and disconnects instantly, since it has no threaded ring. This aids fast removals, helpful when I want to hide the controller before parking in a bad neighborhood. Unfortunately, the six-wire control cable is not a quick disconnect, something that the ICOM fiber optic mobiles do provide.

Conclusions

The FT-4700RH is a terrific radio! I can actually drive it and the car at the same time without scaring other motorists, let alone the people riding with me. The controls are easy to reach, there's no need to switch on the autopilot while checking the frequency, and my front-seat passengers don't have to share their knee room with a sharp-cornered box. The rig is inconspicuous, reliable, versatile, and loud. It'll be burglarproof, too, as soon as I can devise a quick disconnect for the front panel, and some form of dual-band stealth antenna.

Contact Bill Mick K3RVN/G0EZZ at P.O. Box 565 MHS, APO NY 09210-5361. Photos by Susann Mick N2HLK.

Official 1934
SHORT WAVE RADIO MANUAL



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Painless PCBs

Sheds light on the black art of designing a PC board diagram from a schematic.

by Larry R. Antonuk WB9RRT

The topic of etching circuit boards has been thoroughly covered in recent amateur literature. Whether by use of resist pen, dry transfer, photocopier, Dremel tool, positive resist, negative resist, or whatever, each author considers his method to be God's gift to the electronic hobbyist. One thing all of these articles have in common, however, is the assumption that you have access to a perfectly designed, flat-black, camera-ready layout for the board. In other words, someone has already taken the time to develop the circuit schematic diagram into a workable PC board layout, and they were kind enough to include a copy of it with the article.

But what if the project you want to build doesn't come with a PCB layout? Or what if you want to modify an existing layout? What if you actually (shudder) designed the circuit yourself? Is there an easy way to get from the schematic stage to the PCB stage?

The answer to this question, like so many others, is "Yes! Sort of. . ." The best way to learn to develop a printed circuit design is to DO IT. Then do another one. The more you do, the easier they'll get.

There are a few guidelines most hobbyists use, however, whether they're aware of them or not. If followed, these guidelines will make the process clearer, more enjoyable, and more likely to produce a high-quality PCB.

Decide on the Project

This may seem a little backwards, but for the first couple of attempts at PCB design, it's best to chose a project that's not too complicated. Just because you've always wanted a 1 to 1000 MHz/triple conversion/multi-mode receiver doesn't mean that now's the time to start. Instead, pick a small audio or logic circuit—mike preamp, logic probe, battery charger. Something with one or two ICs that you can finish in a reasonable amount of time. Likewise, stay away from RF circuits, especially those that use stripline components. Save the tricky stuff for later.

Breadboard the Circuit

A breadboard is a circuit board, usually made of phenolic or similar material, that has a grid of holes. Components are mounted in the holes and wired together temporarily, usually with hookup wire.

Of all the things that you can do to ensure a successful board, this is the most important. First and foremost, breadboarding lets you check for errors in the circuit diagram. Even if you got the schematic from someone who swears it's correct, you might be interpreting something differently than he did. If it's a magazine article, it will be at least a month before any error corrections are published. There's nothing worse than discovering that you made an absolutely correct printed circuit board from an absolutely wrong schematic.

> *". . . the photocopier method is the all-around best . . ."*

Second, breadboarding the circuit lets you test your components. No use soldering a bad IC into your new board.

Third, you can check out the use of the circuit in its actual application. Is this mike preamp all it's cracked up to be? If you use it for a week on a breadboard, you might decide to scuttle the whole project. Or even make an improvement or two.

Finally, the very act of plugging those parts in on the breadboard will give you a feel for how the completed circuit will look.

Decide on the Process

Obviously, you need to decide on the type of resist method you are going to use. While all of the above-mentioned processes have their strong points, the photocopier method is the all-around best for the casual experimenter. TEC-200 film is without a doubt the best invention to hit the market since the IC socket. Using a photocopier, you can make iron-on resist patterns with this product. (See *Tech Tips* in the April 1989 issue and "PCBs from TEC-200 Film," by K3OF, in the August 1987 issue.)

Even if you use TEC-200, you'll have to come up with a design to photocopy. The dry-transfer process works well, but only if you're positive that you need only one board. Of course, if you're only building a 7805 regulator circuit with a total parts count of four, you'll be done just as quickly if you put the dry-transfers right on the board and skip the photocopy step.

For anything even a bit more complex, it's best to go with the TEC-200 process. Photo resist methods are ideal, as long as your brother-in-law at the print shop lets you use the copy camera for free. Until then, or until you start designing 92-chip, four-layer boards, the photocopier process is just fine.

For discussion, let's assume we're designing a two-chip circuit using TEC-200 film.

Developing the Layout

The overall objective of this stage is simply to get from the schematic and/or breadboard to a complete full size mockup of the board, using dry-transfer (rub on) circuit components.

The first step is to sketch the board. Any type of paper is usable, but tracing vellum is best. You can put the paper with different size grids on it behind the vellum, and they will show through. Work in pencil, starting with the ICs. It's usually easier to produce a "component side" view, so visualize the board as if you were looking at it from above.

Plan on having ground running around the outside of the board, and run the V+ and V− paths. Next work with the signal paths. Don't worry about the relative sizes of resistors and capacitors, just sketch them in place. If you can't make all of the connections without crossing paths, simply sketch in jumpers. Treat them as real components so you don't forget them.

At this point you should have a very ugly representation of your future circuit board. If the board is fairly complex, it may be worth resketching a time or two, to make it cleaner. If it's a simple board you can move to the next step.

Laying Down The Pads

Run down to Radio Shack and get a new package of dry transfers. Take your vellum pad and put the 0.1" grid in place. Grab a cup of coffee. Now, before you do anything else, go through the process of your chosen resist technique in your head. Do it again. Make sure that you know whether you need a positive, a negative, a mirror image, or what. I have seen projects with components soldered

Continued on page 24

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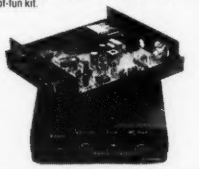
RADIOS



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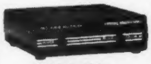

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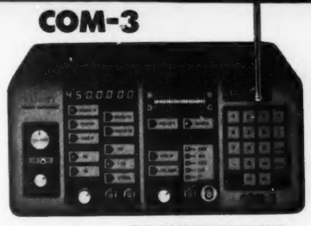

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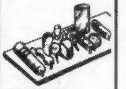

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Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC DBM circuitry . Can also be used to descramble most com. scramblers.
Complete kit, SS-7 **$29.95**
Case kit, CSS-7 **12.95**

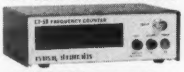
CT-70 7 DIGIT 525 MHz

$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz

$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz



$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz

$189.95 WIRED INCLUDES AC ADAPTER

FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

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Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH CV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

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CIRCLE 34 ON READER SERVICE CARD

Number 10 on your Feedback card

73 Review *by Steven K. Roberts N4RVE*

The Portal System

Now you can easily explore ham radio's most fascinating on-line forum!

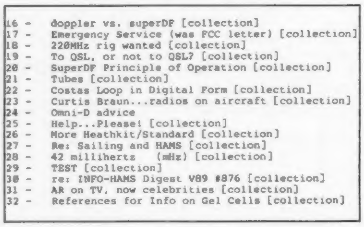
Amateur radio thrives on information. There is so much going on technically, socially, and politically with this complex hobby that those who don't make some effort to keep up are soon in a bit of a fog. ("Just exactly what IS packet?" a ham asked me at a trade show last week, leaning close so his friend wouldn't hear the embarrassing question.) Magazines help tremendously, for they are an edited, packaged collection of articles and graphics coupled with ads from the vendors who keep our technology alive. But what if you want quick answers to your questions, feel the urge to argue about no-code, need the latest Keplerian elements from AMSAT or DX forecasts from the MUF diviners, or just want to hang around and socialize with others? To some extent, we have our own networking technology for those, but neither real-time on-the-air nets nor the packet system have evolved to the point where they are dependable sources of geographically diverse information.

Enter Dataspace

Online, there are two major categories of ham radio information resources. First, there are forums such as CompuServe's HAMNET and GEnie's RT (radio roundtable), offering moderated bulletin-board and conferencing systems. They carry ongoing discussions as well as a growing library of downloadable software, captured online conferences, reference material, reviews, and so on.

The other class of ham-related online conferencing is rec.ham-radio, part of the Usenet (a complex linkage of some 20,000 academic, corporate, and private computer systems around the world). Unmoderated, freewheeling, and not even pretending to offer archives, rec.ham-radio is one of the most dynamic ongoing discussion forums within the ham community.

It's a bit hard to explain the network culture—asking you to imagine 20 years' evolution of packet doesn't quite give you the picture. Dataspace is a complex, multilayered not-land peopled by ghosts, strangers, wizards, and the alter egos of those you know. It's a place with intricate behavioral protocols, obscure symbology intended to increase bandwidth or soften harsh words, and harsh "flaming" of those who overstep the bounds of decency (or understep those of intelligence). This is the information home for millions worldwide, and some of them are hams. Active hams.



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16 -    doppler vs. superDF [collection]
17 -    Emergency Service (was FCC letter) [collection]
18 -    220MHz rig wanted [collection]
19 -    To QSL, or not to QSL? [collection]
20 -    SuperDF Principle of Operation [collection]
21 -    Tubes [collection]
22 -    Costas Loop in Digital Form [collection]
23 -    Curtis Braun...radios on aircraft [collection]
24 -    Omni-D advice
25 -    Help...Please! [collection]
26 -    More Heathkit/Standard [collection]
27 -    Re: Sailing and HAMS [collection]
28 -    42 millihertz   (mHz) [collection]
29 -    TEST [collection]
30 -    re: INFO-HAMS Digest V89 #876 [collection]
31 -    AR on TV, now celebrities [collection]
32 -    References for Info on Gel Cells [collection]
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Screen capture of the rec.ham-radio menu.

Inevitably, this makes it a lively playground. As you can see from the screen capture shown in the figure, the topics range from the public perception of ham radio to technical details of specific rigs. Other topics found among the 86 active discussions present on 9/13/89 included: "KA9Q's TCP/IP software available!", "SOLAR ACTIVITY NR 35", "Interference on 2454 MHz", "Double ducky update", "Poor PRO-34 squelch circuit", "Anyone need Macau (XX9)?", and "Transmitting music for ATV."

The Portal System

There are many sites that carry Usenet newsfeeds, most of them in closed academic and corporate UNIX environments. But there's a way to get there from your own PC via TELENET: the Portal System. Portal is a very user-friendly, brisk online service that provides E-mail, conferencing, and a number of other services . . . with terminal emulator support to make the online session brisk. It has a friendly "local" community, but I'm attracted to it primarily for the public-access Usenet and internet (E-mail) gateway. Best of all, it only costs a flat rate of $10/month plus any communication charges (TELENET or direct dial to Cupertino, CA).

To sign on to Portal, use your modem to call (408) 725-0561, or make a voice call to (408) 973-9111 for more information and an estimate of local charges. To get on the GEnie network, use your modem to call (800) 638-8369, hit HHH when connected, then respond to the U#= prompt with XJM11878,GENIE. On both systems, my electronic mail address is WORDY. See you in Dataspace! ■

Painless PCBs *Continued from page 22*

onto the foil side of the board—don't skip this step!

For our TEC-200 process we need to work from the foil side layout, so we need to reverse the component side we just made. If you used tracing vellum, just flip it over and trace over the paths. If you used regular paper, hold the sheet on a window and use the window as a light table.

Once you have the polished foil side sketch in front of you, you can go to work. Using the 0.1" grid, place the rub-on IC outlines in place near the middle of the board, making sure there's ample room between them. Again, if you start in the middle and work out, you can always make the board larger. Not so in reverse.

> ***". . . start in the middle and work out . . ."***

Rub down the power and ground paths, then start on the components. Now the size is critical. The resistors, etc., can be measured, and the measurements transferred to the layout. You may use a pair of dividers or a compass to transfer the dimensions. Or you can rub down one pad and hold the part above it, eyeballing the location of the second pad, whatever works best for you. Continue this process until the whole board is in place.

A Few Pointers

A straight line is indeed the shortest distance between two pads, but it's not the prettiest. All of your components, and all of the copper paths, should be running either vertically or horizontally. That's what the vellum pad grid is for.

Make use of large "ground plane" areas running around the perimeter of the board and coming right into the active circuit area. Mark the areas off with rub-on paths, and fill them in with ink. Likewise, use large areas for the V+ points. This practice helps reduce feedback and noise, makes your acid go farther, and gives you some space to correct things if you forget an A+ or A− wire.

Pay close attention to the points where wires leave and enter the board. For some reason, it's very easy to omit pads here.

Use large enough paths for the job—power runs are wider than signal runs. Don't run paths too close together—this causes crosstalk and high voltage arcing. Pads should be the correct size for their components.

Finishing Touches

Once the layout is finished, think about future expansion. Add a few pads to the power and signal points in case you ever want to tap off for another circuit. Decide where the holes should be for mounting the board, and put pads there to act as center punch points. Get some rub-on letters, and mark the power connections, switch connections, even the ICs. Make it pretty. Remember, each time it gets easier and easier! ■

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$12,000,000 Scanner Sale

Uniden Corporation of America has purchased the consumer products line of Regency Electronics Inc. for $12,000,000. To celebrate this purchase, we're having our largest scanner sale in history! Use the coupon in this ad for big savings. Hurry...offer ends March 31, 1990.

★★★*MONEY SAVING COUPON*★★★

COUPON COUPON

Get special savings on the scanners listed in this coupon. This coupon must be included with your prepaid order. Credit cards, personal checks and quantity discounts are excluded from this offer. Offer valid only on prepaid orders mailed directly to Communications Electronics Inc., P.O. Box 1045 – Dept. UNI3, Ann Arbor, Michigan 48106-1045 U.S.A. Coupon expires March 31, 1990. Coupon may not be used in conjunction with any other offer from CEI. Coupon may be photocopied. Add $12.00 for shipping in the continental U.S.A.

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Regency R1099-T	**$99.95**
Regency RH606B-T	**$419.95**
Regency RH256B-T	**$294.95**
Bearcat 200XLT-T2	**$229.95**
Bearcat 100XLT-T	**$184.95**
Bearcat 800XLT-T2	**$229.95**
Uniden HR2510-T	**$229.95**
Uniden HR2600-T	**$274.95**
Uniden PRO500D-T2	**$29.95**

COUPON COUPON

★★★★*VALUABLE COUPON*★★★★

Bearcat® 760XLT-T

List price $499.95/**CE price $244.95/SPECIAL**

12-Band, 100 Channel • Crystalless • AC/DC

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.

Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 760XLT has 100 programmable channels organized as five channel banks for easy use, and 12 bands of coverage including the 800 MHz. band. The *Bearcat* 760XLT mounts neatly under the dash and connects directly to fuse block or battery. The unit also has an AC adaptor, flip down stand and telescopic antenna for desk top use. 6-5/16" W x 1⅝" H x 7⅜" D. Model **BC 590XLT-T** is a similar version without the 800 MHz. band for only $194.95. Order your scanner from CEI today.

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R4010-T *Regency* 10 channel handheld scanner	$114.95
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P300-T *Regency* 40 channel SSB CB Mobile	$137.95
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Regency® RH256B-T

List price $799.95/**CE price $299.95/SPECIAL**

16 Channel • 25 Watt Transceiver • Priority

The *Regency* RH256B is a sixteen-channel VHF land mobile transceiver designed to cover any frequency between 150 to 162 MHz. Since this radio is synthesized, no expensive crystals are needed to store up to 16 frequencies without battery backup. All radios come with CTCSS tone and scanning capabilities. A monitor and night/day switch is also standard. This transceiver even has a priority function. The RH256 makes an ideal radio for any police or fire department volunteer because of its low cost and high performance. A *60 Watt* VHF 150-162 MHz. version called the **RH606B-T** is available for $429.95. A UHF 15 watt, 16 channel version of this radio called the **RU156B-T** is also available and covers 450-482 MHz. but the cost is $454.95.

★★★ *Uniden CB Radios* ★★★

The *Uniden* line of Citizens Band Radio transceivers is styled to compliment other mobile audio equipment. Uniden CB radios are so reliable that they have a two year limited warranty. From the feature packed PRO 810E to the 310E handheld, there is no better Citizens Band radio on the market today.

PRO310E-T *Uniden* 40 Ch. Portable/Mobile CB	$83.95
PRO330E-T *Uniden* 40 Ch. Remote mount CB	$104.95
PRO500D-T *Uniden* 40 Channel CB Mobile	$38.95
KARATE-T *Uniden* 40 channel rescue radio	$53.95
GRANT-T *Uniden* 40 channel SSB CB mobile	$166.95
MADISON-T *Uniden* 40 channel SSB CB base	$244.95
PC122-T *Uniden* 40 channel SSB CB mobile	$119.95
PRO510XL-T *Uniden* 40 channel CB Mobile	$38.95
PRO520XL-T *Uniden* 40 channel CB Mobile	$56.95
PRO530XL-T *Uniden* 40 channel CB Mobile	$79.95
PRO540E-T *Uniden* 40 channel CB Mobile	$97.95
PRO640E-T *Uniden* 40 channel SSB CB Mobile	$137.95
PRO710E-T *Uniden* 40 channel CB Base	$119.95
PRO810E-T *Uniden* 40 channel SSB CB Base	$174.95

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Buy the finest *Uniden* radar detectors from CEI today.

TALKER-T2 *Uniden* talking radar detector	$144.95
RD7-T *Uniden* visor mount radar detector	$99.95
RD9-T *Uniden* "Passport" size radar detector	$114.95
RD9XL-T *Uniden* "micro" size radar detector	$144.95
RD25-T *Uniden* visor mount radar detector	$54.95
RD500-T Uniden visor mount radar detector	$74.95

Bearcat® 200XLT-T2

List price $509.95/**CE price $239.95/SPECIAL**

12-Band, 200 Channel • 800 MHz. Handheld
Search • Limit • Hold • Priority • Lockout

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz.

Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T2

List price $549.95/**CE price $239.95/SPECIAL**

12-Band, 40 Channel • No-crystal scanner
Priority control • Search/Scan • AC/DC

Bands: 29-54, 118-174, 406-512, 806-912 MHz.

Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/**CE price $94.95/SPECIAL**

10-Band, 16 Channel • No-crystal scanner
Priority control • Weather search • AC/DC

Bands: 29-54, 136-174, 406-512 MHz.

The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/**CE price $239.95/SPECIAL**

10 Meter Mobile Transceiver • Digital VFO
Full Band Coverage • All-Mode Operation
Backlit liquid crystal display • Auto Squelch
RIT • Preprogrammed 10 KHz. Channels

Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.

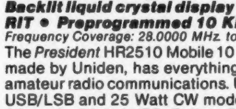
The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

NEW! President® HR2600-T

List price $599.95/**CE price $299.95/SPECIAL**

10 Meter Mobile Transceiver • New Features

The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.



BC760XLT
800 MHz.
mobile scanner
SPECIAL!

★★★*Uniden Cordless Telephones*★★★

XE750-T *Uniden* Cordless Phone with speaker	$99.95
XE550-T *Uniden* Cordless Phone	$79.95
XE300-T *Uniden* Cordless Phone	$69.95

★★★ *Extended Service Contract* ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to three years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. A two year extended contract on a mobile or base scanner is $29.99 and three years is $39.99. For handheld scanners, 2 years is $59.99 and 3 years is $79.99. For radar detectors, two years is $29.99. For CB radios, 2 years is $39.99. For cordless phones, 3 years is $34.99. Order your extended service contract today.

OTHER RADIOS AND ACCESSORIES

BC55XLT-T *Bearcat* 10 channel scanner	$114.95
BC70XLT-T *Bearcat* 20 channel scanner	$159.95
BC175XLT-T *Bearcat* 16 channel scanner	$156.95
R2066-T *Regency* 60 channel scanner	$149.95
R1099-T *Regency* 45 channel scanner	$109.95
TS2-T *Regency* 75 channel scanner	$269.95
UC102-T *Regency* VHF 2 ch. 1 Watt transceiver	$114.95
BPS5-T *Regency* 16 amp reg. power supply	$179.95
BP205-T1 Ni-Cad batt. pack for BC200/BC100XLT	$39.95
B8-T 1.2 V AA Ni-Cad batteries (set of eight)	$17.95
FBE-T Frequency Directory for Eastern U.S.A.	$14.95
FBW-T Frequency Directory for Western U.S.A.	$14.95
RFD1-T Great Lakes Frequency Directory	$14.95
RFD2-T New England Frequency Directory	$14.95
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RFD5-T N.W & Northern Plains Frequency Dir.	$14.95
ASD-T Airplane Scanner Directory	$14.95
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TSG-T "Top Secret" Registry of U.S. Govt. Freq.	$14.95
TTC-T Tune in on telephone calls	$14.95
CBH-T Big CB Handbook/AM/FM/Freeband	$14.95
TIC-T Techniques for Intercepting Communications	$14.95
RRF-T Railroad frequency directory	$14.95
EEC-T Embassy & Espionage Communications	$14.95
CIE-T Covert Intelligence, Elect. Eavesdropping	$14.95
MFF-T Midwest Federal Frequency directory	$14.95
A60-T Magnet mount mobile scanner antenna	$35.95
A70-T Base station scanner antenna	$35.95
A1300-T 25 MHz.–1.3 GHz Discone antenna	$109.95
USAMM-T Mag mount VHF ant. w/ 12' cable	$39.95
USAK-T ¾" hole mount VHF ant. w/ 17' cable	$35.95

Add $4.00 shipping for all *accessories* ordered at the same time. Add $12.00 shipping per radio and $4.00 per antenna.

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CIRCLE 121 ON READER SERVICE CARD

Continuity Beeper

The ultimate in continuity checking convenience.

by Dick Fergus W9DTW

This circuit is a beeping continuity tester with a couple of twists. First, the testing power has been reduced to eliminate possible component damage. The low power also allows you to test circuits with the ICs in place, and it won't be fooled by forward conducting junctions. The open circuit test voltage is less than 50 mV, while the test current is less than 1 mA.

Second, the circuit is battery powered with an automatic power-down feature. It has no on/off switch. It powers up when you touch one of the test probes to the appropriate point. Each continuity test resets the turn-off delay, and the power will stay on for two to three minutes after the last test. Battery life for continuous operations should be about 50 hours. With the automatic power-down, the battery should be good for shelf life.

Audible Continuity Testers

The obvious advantage to such a tester is the instantaneous indication of continuity (beep) when the probes make contact. You don't need to hold the probes on the contacts while you turn to look at an ohmmeter. Using the latter, I have been frustrated when the probes would slip off the contact as I turned to look at the meter.

Another advantage of the audible continuity tester is that you can check for unwanted circuit paths. I usually drag the test probe along the socket or component pins as I look for the intended point. If a short or unwanted connection exists, I will hear a beep indicating continuity.

This method is also useful for tracing circuit paths. Just put one probe on a connection, then drag the other probe around the board until you hear a beep. This can be a real help on two-sided boards or boards with hidden traces.

Circuit Overview

See Figure 1. A dual comparator IC (U2, LM393) detects the continuity and generates an audible tone. Comparators generate output voltages which compare two inputs. If the minus (inverting) input is negative with reference to the plus (noninverting) input, then the output will be positive. If the difference polarity is reversed, the output voltage is reversed. Most comparators are very sensitive, and it only takes a few millivolts difference to produce a maximum output voltage swing.

Note that it's the voltage difference between the two inputs, and not the voltage from ground (common mode) that's important. There is a limit on the common mode range, but that's not important right now.

Circuit Details

Again referring to Figure 1, the inverting input of U2A (pin 2) is biased to about 45 millivolts by R5 and R7. This voltage is greater than the noninverting input (25 millivolts). Since the noninverting input is less positive (negative) than the inverting input, the output must be at the minimum voltage or ground.

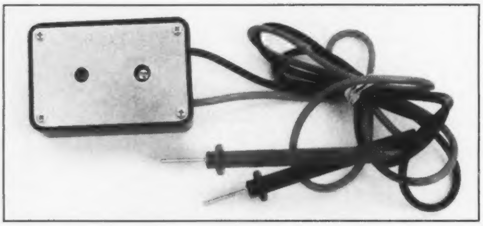
Photo A. W9DTW's audible continuity checker.

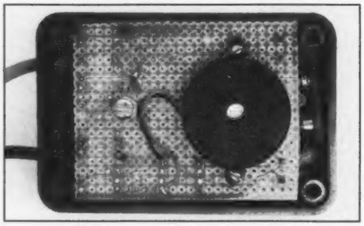
Photo B. Speaker side of the continuity checker board.

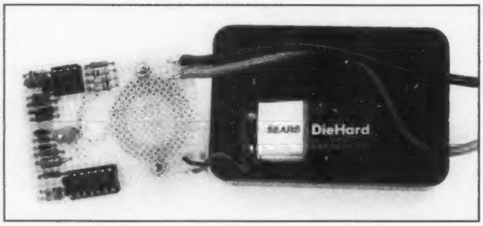

Photo C. Component side of the continuity checker board.

Actually, the output of this comparator is an isolated transistor collector and, in this case, the transistor is conducting. This output transistor will remain conducting until the inverting input is reduced to less than 25 millivolts. A path of less than 50Ω (circuit continuity) through the test leads will reduce this voltage and the output transistor will cease conducting.

The tone generator (U2B) produces a square wave at pin 7 when pin 6 is not shorted to ground by the U2A transistor. (The bottom test probe line is ground.) In this condition, C3 is alternately charged and discharged by the output signal through R12. The output signal also changes the voltage on U2B (pin 5). When the output is high, pin 5 is about 6 volts and C3 will charge until this voltage is reached.

When the C3 voltage exceeds the pin 5 voltage, the comparator switches to a high voltage and the cycle repeats. The output square wave drives the piezo transducer (speaker) and a "keep alive" circuit (C1, D1, and D2).

Auto Off

Battery power is controlled by a CMOS (complimentary FET) array (U1 CD4007). When C2 is discharged (by momentarily touching a test lead to ON), the P1-13 will drive the N2 gate to 9V. N2 then drives P3 on, and supplies power through pin 12, the main circuit.

If the beeper isn't used for a while, C2 will slowly charge. At some voltage, the P1 will start to reduce conduction and allow P2 to conduct. As P2 conducts, the current through R2 increases the charging of C2, thereby causing positive feedback and a very rapid power turn-off.

In the power-off condition, all FETs are nonconducting, so battery current will be only a few microamps. Each time you make a continuity test, the "keep alive" circuit discharges C2 with the rectified current through C1 from the output signal.

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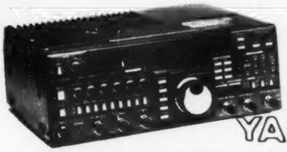

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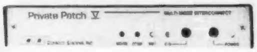

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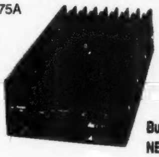

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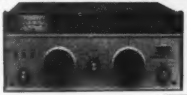

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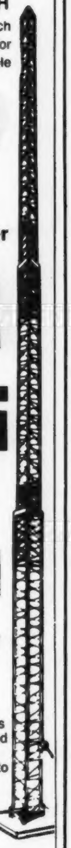

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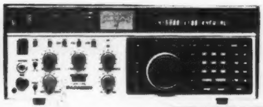

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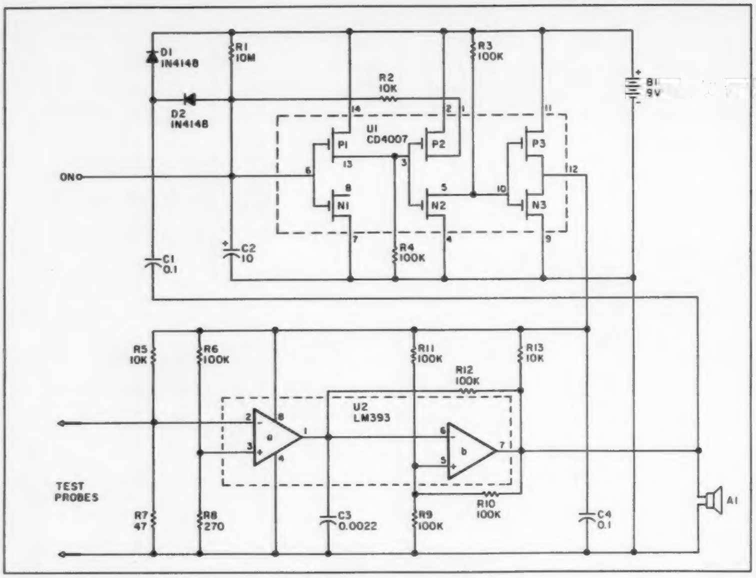

Figure 1. Continuity beeper schematic.

indicate continuity. In digital applications, you run into this condition very seldom.

This beeper has proven very useful. With complex computer circuitry, I've found that a few minutes spent "beeping" the circuit can save a lot of headaches. It's much easier to find a wiring error by beeping than by debugging with the scope.

For those who are forgetful, the auto power-off saves battery life. It isn't the cost of battery replacement that's the problem. It's that batteries are usually dead at the most inopportune time. That must be somebody's law—probably a Murphy corollary. 73

Construction

Layout or type of construction is not critical. Most of the U1 circuitry is very low current, therefore good insulation is necessary, especially around R1 and C2. The case is necessary only for physical protection. Since you don't have to mount anything to the case, you can assemble the circuitry in one piece with the test and battery leads connected. With slots for the test leads and clearance holes for the ON contact and transducer, you can stuff the circuitry into the case. The transducer does not make a lot of noise, so you may have to experiment to get satisfactory volume.

Easy to Use

To turn power on, touch either test lead to the ON.

To test continuity, touch test leads to circuit; if continuous, you will hear a beep.

Power will remain on for several minutes after the last test.

Note: Circuit resistance less than 50Ω will

Dick Fergus W9DTW has been a ham since 1947, and is especially interested in computer applications to ham radio. Dick is currently an electronic engineer for a mid-western firm. Other interests include building and flying private planes, and working on the detection of severe weather by electronic means. You can reach Dick at 2N570 Argyle St., Lombard IL 60148.

Parts List

Part	Description	Jameco	Radio Shack		Cost
A1	Piezo Transducer		273-073		$.99
B1	9V Battery		23-464		.59
C1,4	0.1 µF 50V	DC.1/50		@ .15	.30
C2	10 µF 35V Tan.	TM10/35			.59
C3	0.0022 µF 100V	MY.0022/100			.10
D1,2	1N4148	1N4148		@ .07	.14
R1	10m 5% 1.4W	R10m			.05
R2,5,13	10k 5% ¼W	R10k		@ .05	.15
R3,4,6,9,10,11,12,13	100k 5% ¼W	R1k		@ .05	.40
R7	47 5% ¼W	R47			.05
R8	270 5% ¼W	R270			.05
U1	CD4007	CD4007			.25
U2	LM393	LM393N			.39
2 Sockets 14-pin		14LP		@ .12	.24
Battery Connector			270-325		.20
Case			270-231		1.69
Test Leads			278-712		1.69
				Total Cost	$7.87

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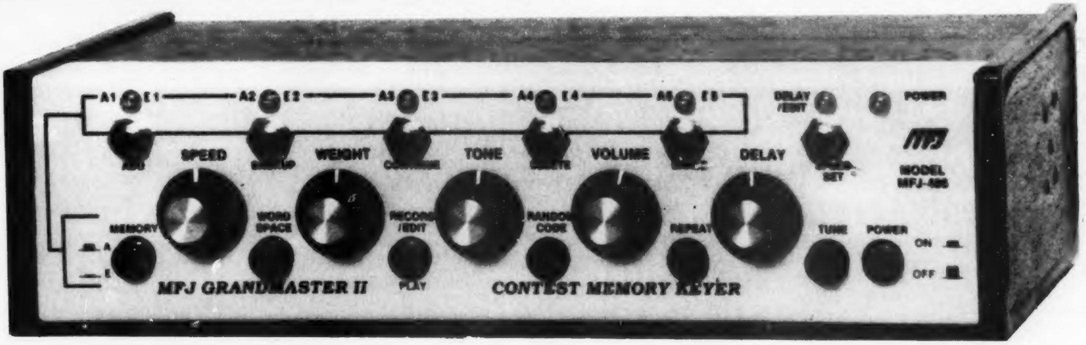

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73 Review *by Steven K. Roberts N4RVE*

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A spectrum analyzer is simple in concept. Just imagine sweeping the center frequency of a filter upwards from a low value, displaying the amplitude of the signal that passes through it on a scope that sweeps at the same rate. If you repeat this quickly in synchrony with the scope trace, you have a spectrum plot, with horizontal displacement indicating frequency and vertical indicating amplitude. Put an antenna on it, and you have a snapshot of the electromagnetic spectrum.

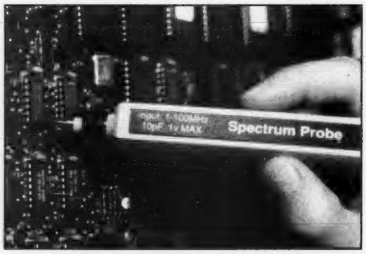
The problem is that most spectrum analyzers are expensive—$10–$40,000 from the major instrument vendors. Isn't there a way to hang something on the front of a cheap oscilloscope to produce the same effect?

A Spectrum Plot—Cheap

Indeed there is. A new product from Smith Design looks like a fat scope probe, but actually works as a 1–100 MHz spectrum analyzer. It lacks the features that make the expensive ones a delight to use. There are no cursors to give you digital indication of a peak's frequency, nor are there controls of any kind other than those on the scope. Determining frequency with accuracy involves a bit of guesswork and interpolation (delayed sweep helps)—but still, it's a spectrum plot. This can be incredibly useful if you're trying to track down digital noise, spot strange and unwelcome harmonics, detect impulse energy like arcing or intermittents, or otherwise peer into a signal environment that looks like clutter on a time-domain scope.

Using the unit is simple. A wall transformer (supplied) plugs into one spur of a split cable, and the other plugs into the BNC vertical input of your scope. Set the vertical attenuation to 50 mV/div, the sweep to 0.5 ms/div, and sync negative. The resulting display is logarithmic in amplitude, with a range of about 50 dB. If you touch your finger to the tip, you see a display of AM, low-band VHF, TV channels 2–6, and about half the FM broadcast band. Transmit on HF nearby, and the display goes crazy. The probe presents a very small load to the circuit under test—only 10pF, comparable to a standard scope probe.

This tool isn't of the highest quality, but it's very useful. The evaluation unit was dead on arrival, but the problem turned out to be trivial—an intermittent short in the connection to the female 3.5mm power socket. The Spectrum Probe's connectors, product packaging, and general construction techniques appear cheap, and the documentation is not well written—but in all fairness, this is not pretending to be a Hewlett-Packard. It's very well worth its modest price!



The Smith Design spectrum analyzer probe.

The Spectrum Probe is a clever and useful tool if you have a fairly casual but recurring need to see what's happening in the 1—100 MHz frequency domain. I'll probably carry it on my next bicycle trip (along with the Createc handheld scope) to help sniff out logic-generated noise problems and other leakage. There's certainly enough of that to keep the device busy. ■

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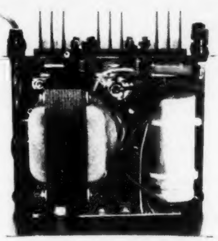

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- THREE CONDUCTOR POWER CORD
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PERFORMANCE SPECIFICATIONS

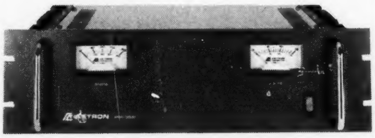
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- **Also available with 220 VAC input voltage**

MODEL RS-50A

MODEL RS-50M

MODEL VS-50M

RM SERIES



MODEL RM-35M

19″ × 5¼ RACK MOUNT POWER SUPPLIES

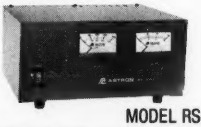
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

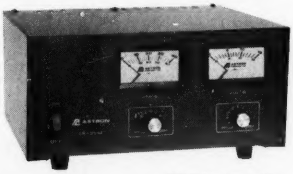
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

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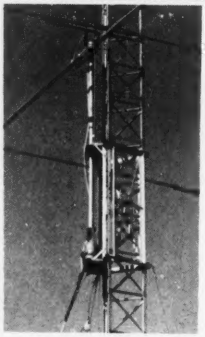

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CIRCLE 72 ON READER SERVICE CARD

The art of small talk

Introducing the only compact HT designed for you—Heath's new 2-meter and 450 MHz Micro-Deluxe handheld transceivers.

Built with a receiver sensitivity of 0.158 µV for 12 dB SINAD, the micro-sized HW2P or HW4P measures an unbelievable 4-3/8"H x 2-1/16"W x 1-1/4"D. Battery-packs hinge onto the back of the unit so the HT retains the same basic form, even with the largest capacity batteries. Slip it into your pocket or hook it on your belt - no more hassles with bent clips or tangles with car seatbelts. Heath's new micro-HTs will go anywhere you do.

The art of Easy Operation. Enter frequencies directly from the full-function keyboard or QSY from the displayed frequency via the rotary frequency selector. Scan between two frequencies, Scan 1 Mhz or scan all except between two frequencies. Scan favorite memory channels (useful for temporarily locking out a busy channel), scan first ten memory channels, last ten or all twenty. All scanning modes support either Pause Scan (stop on active channel then resume) or Busy Scan (stop on active channel and hold). One button Call channel is a quick way to get to your favorite repeater or simplex frequency.

Heath
HW2P
PAG 1
C SQL 2
CODE 3
PTT L A/F.L
DUP 4
REV 5
100K 6
SFT B/SC
APO T 7
SAVE T 8
F/CH 9
T SQL C/L L
CLOCK */▲
TIMER 0
PWR #/▼
STEP D/BZ

HW2P shown actual size.

The art of Low Power Consumption. With only 46 mA required for RX squelched, and 1200 mA for full 5 watts TX output, these new handhelds are the most efficient designs available. A nine-step battery saver defaults to 22 mA in receive, but life can be further extended, approaching only 10 mA average RX current squelched.

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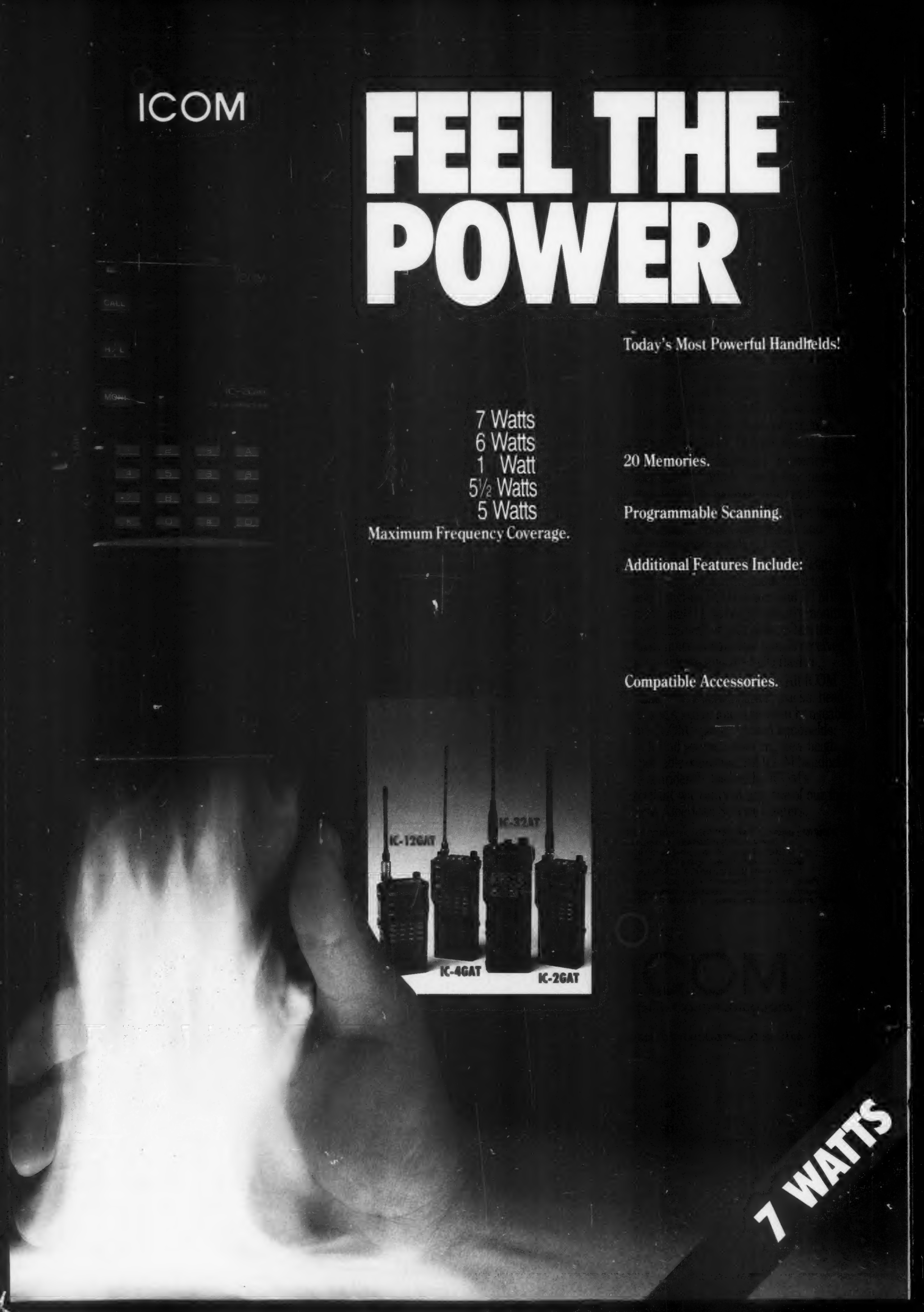
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IC-2GAT
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73 Review

by Jim Bail KA1TGA

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So you've decided to get your ticket or to upgrade? Do you own or have access to an IBM or clone? If you answer yes to both questions, then make the learning fun—boot up PC QSO Tutor.

QSO Tutor works on any IBM or clone with 256K of memory or more. The screens look good on either a color or monochrome monitor.

What is QSO Tutor?

It is an MS-DOS program that includes all of the questions in the question pool for the license class for which you are studying. In its simplest form, it serves as a computerized deck of flash cards, but to leave it at that would not do it justice.

QSO Tutor takes advantage of the computer's ability to sort the questions in a variety of useful ways. The questions are organized into categories that match the chapters in the equivalent ARRL study guide, such as Signals and Emissions, Electrical Principles, etc. When you start a session, you can choose to be tested in only selected categories, all categories, or "auto-weighted," in which the Tutor drills you on the categories it sees you are weak in. You can also select a sample test like the one you will take with the Volunteer Examiner (my favorite of all the options). The program keeps a running score displayed on the screen, and, with the stroke of a key, it displays a breakdown of your score by category.

How to Use It

The Tutor is menu-driven, so you don't need to be a whiz to get around. Pop it in, boot it up, and start your session. The program then sorts its questions and displays a randomly selected question just as it would appear on the FCC exam. It tells you immediately whether your answer is right or wrong, and tells you the correct response. On some of the questions you have the option of getting an explanation of the answer after you have made your choice.

QSO Tutor is NOT a replacement for the license manual. It does, however, serve as a tremendous complement. I found that by paying close attention to the questions I missed, I was drawn to the manual for a stronger understanding.

One great example of this is the previously mentioned sample test option. Each night after work I take at least three separate tests (each takes about 15 minutes) and record my score in each category. In short order my weakest areas become apparent. I simply focus my studies on those areas, then drill myself on all of the category pools.

Thumbs Up

QSO Tutor's random generation of questions is more than acceptable. Besides a few misspelled words, the question pool is free from distracting errors. It would be nice, however, if the program would record test scores automatically. QSO Software plans to add this function in future versions, but for now you have to manually track your progress.

QSO Tutor is available for all of the classes, each with a second disk that includes schematics for the questions that deal with them. All of the license class programs operate in the same pattern.

Do I recommend the QSO Tutor? Heartily, yes! It really motivated me, and it's a great way to test my progress. The learning is a natural by-product of the fun I am having! ■

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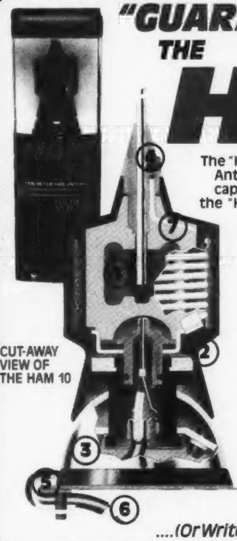

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73 Review

by C.L. Houghton WB6IGP

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1.2 GHz in a hand-held? There are still parts of the country where VHF and UHF repeater allocations are uncongested, but not out here in Southern California! Also, there are advantages to hand-held operation on this band over the lower frequencies—read on to find out about them!

Initial Impressions

I was struck by the simple and convenient control layout. If you're familiar with ICOM products, you'll likely be able to operate the 12GAT right out of the box. On the top panel are full frequency-setting rocker switches, especially handy since I like to use my HT on my belt or in a top coat pocket. The display panel and volume and squelch controls are also conveniently mounted on top. To change frequency on the other HTs, I had to dismount the HT to look at the front panel.

The unit is about 1 inch shorter than an IC-04 equipped with an 8.4 volt battery pack. All of my questions were answered by the well written instruction booklet that came with the radio.

Operating the 12GAT

The transceiver has two power levels: 1 Watt, and 0.1 Watt. Operating with a 13 volt battery package won't increase the power output because the internal power module won't output more than one Watt. On the two units I was given for test evaluation, both measured rated power output to within 0.2 dB across the entire 1200 MHz band from 1243 MHz to 1300 MHz. The radio's specifications guarantee operation from 1260 MHz to 1300 MHz, but it will actually operate down to 1243 MHz before the synthesizer unlocks.

Field Tests

N6IZW and I made several tests comparing the 23 cm operation with 2 meters for path loss performance. Both N6IZW and I used IC-02ATs for the 2 meter comparisons.

Because microwaves often suffer greater path attenuation—especially with organic material (e.g. trees) in the path—than lower frequency energy, we weren't surprised at its reduced range. When the path on two meters was noisy, contact on 1200 MHz was impossible. Additionally, when we tried a path three miles distant, below tree level (semi-line-of-sight), contact was not readable on 1200 MHz using the rubber duck antenna. (Antennas were limited to the rubber duck for all tests.) Also, rapid movement gave a very noticeable multipath flutter to the received signal.

Since microwaves are smaller than two meter waves, would they more easily pass through small apertures? We found this to be the case. When using a repeater situated about six miles from both of our locations, it did not matter if we were inside a car or in our respective shacks: The results were excellent quality. We were able to make contact through a variety of structures I previously thought impossible to penetrate. Reverting to 2 meters for comparison proved the 12GAT better in radiating out of the inside of cars and other confined spaces, giving a good accounting of itself over short paths.

IMD?—What IMD?

We used the WA6ZST 1200 MHz repeater for the tests. To my surprise, I was able to access this same repeater from my work location in downtown San Diego, normally a shielded location. Signal reports using the repeater were very good despite being shielded by the building and by a 200 foot hilltop in the path to the repeater.

Operating this HT in a very large computer center gave me a pleasant surprise. With many different disk drives and other data processors, all generating RFI, this had been difficult for my 2 meter HT, taking it to intermod city. There was no such interface problem with the IC-12GAT.

To properly get into the repeater from inside the building, I had to hold the antenna very steady once I located the "sweet zone" providing a good path to the repeater. I found this spot through trial keying up and checking my return. This "sweet spot" or antenna orientation was a very small defined position, and I found many of them within a 2 foot radius. There were many very small peaks and nulls as I made a vertical movement to find the best spot. A slight movement would make my signal unreadable. Holding still provided very good quality on a QSO for 20 minutes.

Special Features

The 12GAT has 20 memory channels and a priority call channel. All 38 subaudible tones (CTCSS tones) can be programmed with ease, without a chart, because the display reads the tone frequency instead of a tone number. This is a nice feature not found even on the IC-0xAT series radios. Additionally, you can equip the HT with an optional UT-40 tone squelch unit to allow it to function as a tone-activated pager. Again, you can se-

The ICOM 12GAT 1200 MHz Transceiver: Technical Specifications

Frequency Coverage	1240–1300 MHz 1260 to 1300 MHz guaranteed
Receive Sensitivity	0.2 µV for 12 dB SINAD
Squelch Threshold	Less than [illegible]
Spurious Rejection	Greater than 60 dB [illegible]
Power Supply	8.4 volts standard 5.5 volts to 13 volts [illegible]
Current Drain 13.2 V	Receive max audio output 250 mA Receiver power saver on [illegible] Transmit high power 900 mA Transmitter low power 400 mA
Spurious Emissions	Less than −60 dB
[illegible]	[illegible]

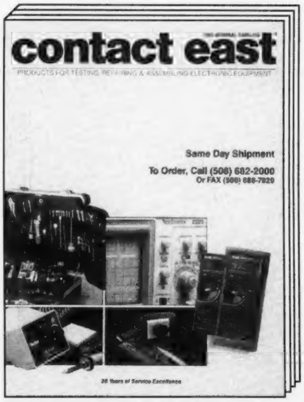
lect the tone you wish to respond to. This capability, combined with the battery saver option that reduces power consumption to 24 mA, greatly extends its operating time on a single charge.

ICOM uses a TNC coaxial connector for the antenna on this radio. This appears to be a thread-on version of the BNC connector, but is rated for use up to 12,000 MHz (12 GHz) with little loss. A very important factor at these frequencies!

You can operate the IC-12GAT using all of the IC-02's accessories. ICOM has put the connector for the remote microphone on the side of the radio in order to make room for all the controls on the top of the radio.

A Winner!

I was very impressed with the quality of construction and the smooth operation of the 12GAT. I enjoyed many long QSOs on local 1200 MHz repeaters. I did not feel that I was tying up repeater use and should therefore terminate contact. Operation in this part of the frequency spectrum allows longer contacts and removes you from the crowded band conditions found on 2 meters and 70 cm. The 23 cm band is 60 MHz wide, giving plenty of room for repeater operation. I recommend the 12GAT for anyone who is interested in 1200 MHz HT operation. ▣



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CIRCLE 382 ON READER SERVICE CARD

G5RV All-Band QuickKits™

Fast & Easy to Build
- Failsafe visual instructons
- No measuring or cutting
- Everything included
- Finish antenna in minutes

Quality Components
- Presoldered Coax Fittings
- Kinkproof QuietFlex wire
- Fully insulated, wx sealed, no-corrode, low noise design

Fastest Antennas in the West
AntennasWest
(801) 373-8425

Double Size G5RV 204 ft 160-10 Dipole	$59.95
Full Size G5RV 102 ft 80-10 Dipole	$34.95
Half Size G5RV 51 ft 40-10 Dipole	$24.95
Quarter Size G5RV 26 ft 20-10 Dipole	$19.95
Marconi Adapter kit converts any dipole to Marconi	$ 4.95
200' Dacron 250# line	$11.95
Add $5 Post & Handling	Info $1

Box 50062-S, Provo, UT 84605

CIRCLE 107 ON READER SERVICE CARD

"I learned all my code and theory while driving to and from work, it was easy." Learn detailed theory not only the questions and answers on your test. Novice, Tech., General, Advanced, Extra theory courses on audio cassettes $19.95 each.

Learn code from 0-23 wpm with one structed course in easy steps. Each cassette course **$19.95**. VEC type code General or Extra exam tape C90 **$7.95 ea. $3.00** S/H each theory or code course. Exam tapes **$1.00**

THE VIDEO NOVICE

VHS video cassettes will show you everything you need to know to pass your Novice, Tech or General theory test. Learn modulation, formulas, antennas, digital codes and more just by watching your TV. All courses are two 2-hour VHS video cassettes and one C-90 audio cassette. **$39.95** plus **$5.00** S/H. 100% money back guarantee.

New code words course takes you from 10 wpm to 35 wpm with three 90 minute audio cassettes. Learn common words and numbers used in all CW contacts. Nothing to write down. Learn at your leisure **$19.95 + $3.00** P&H.
Write or call for free info.

AMATEUR RADIO SCHOOL

2350 Rosalia Drive ■ Fullerton, California 92635
(714) 990-8442

CIRCLE 288 ON READER SERVICE CARD

INTRODUCING OUR NEW COMPUTER-CONTROLLED

REP-200 REPEATER

If you always thought a computer-controlled repeater had to be expensive, LOOK AGAIN! You could easily spend this much just for a controller.

As always, Hamtronics strives to give *superb performance* at *modest cost!* In this case, a premium repeater with versatile computer control, autopatch, and many dtmf control features at *less than many charge for a bare-bones repeater!*

We don't skimp on rf modules, either! Check the features on R144 Receiver, for instance. GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

We completely re-thought the whole idea of what a repeater should be, to give the *best features* at the *lowest cost.*

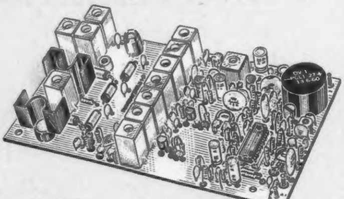
ONLY $1295!

hamtronics
REP-200 REPEATER
SQUELCH
MONITOR VOLUME

- Available for the 10M, 6M, 2M, 220MHz, 440MHz, 902MHz ham bands. ***FCC type accepted** models also available for vhf and uhf commercial bands.*
- **Rugged exciter and PA**, designed for continuous duty.
- Power output 15-18W (25W option) on 2M or hi-band; 15W on 220MHz; 10W on uhf or 902MHz.
- Accessory add-on PA's available with **power levels up to 100W**.
- **Five courtesy beep types**, including a pleasant multi-tone sequence.
- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
- **Reverse Autopatch**, two types: auto-answer or ring tone on the air.
- **DTMF CONTROL**: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra **4-digit owner password**.
- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- Many **built-in diagnostic** & testing functions using microprocessor.
- Color coded led's **indicate status** of all major functions.
- **Welded partitions** for exciter, pa, receiver, and controller. PEM nuts for covers.
- 3-1/2 inch aluminum rack panel, finished in eggshell white and black.
- **Auxiliary receiver input** for independent control or **cross linking repeaters**.

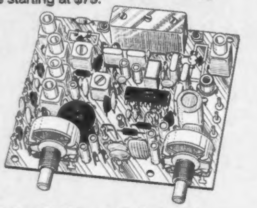
There are many other features, too numerous to mention. Request catalog for full details.

HIGH PERFORMANCE XMTRS & RCVRS FOR REPEATERS, AF & DIGITAL LINKS, TELEMETRY, ETC.



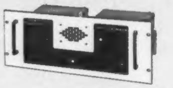
FM EXCITERS: kits $99, w/t $169. 2W continuous duty. TCXO & xtal oven options available. *FCC type accepted for com'l uhf & hi bands.*

- **TA51** for 10M, 6M, 2M, 150-174, 220MHz.
- **TA451** for uhf.
- **TA901** for 902-928MHz, 0.5W out (w/t only, $169).
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output from 10W to 100W. Several models, kits starting at $79.



FM RECEIVERS: kits $139, w/t $189.

- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift.
- **R451 UHF FM RCVR**, similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
- **R76 ECONOMY FM RCVR** for 10M, 6M, 2M, 220MHz, w/o helical res. or afc. Kits $129.
- **Weather satellite & AM aircraft rcvrs** also available.



If you prefer a plain-vanilla or kit repeater, you couldn't find a better value than our original

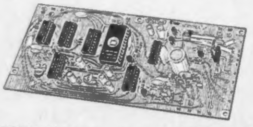
REP-100 REPEATER

Same fine rf modules as REP-200 but with COR-4 Controller. Can add autopatch, dtmf decoder, CTCSS, either now or later. **Kit only $675, w/t $975.**

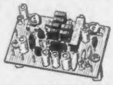
ACCESSORIES

COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier $49

CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .... $59

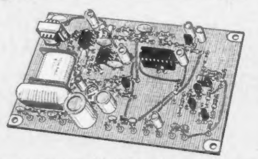


NEW COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call .. $99



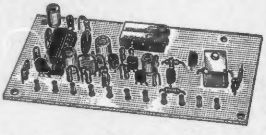
NEW TD-3 SUBAUDIBLE TONE DECODER/ENCODER kit. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions $24

TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79



AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std . $79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiver $39



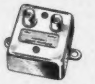
MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39

DE-202 FSK DEMODULATOR kit. For receive end of link. $39

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of new MO-96 Modem and special versions of our 220 or 450 mHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W. *Call for more info on the right system for your application!*

GaAs FET PREAMPS

at a fraction of the cost of comparable units!



LNG-(*)

ONLY **$59**
wired/tested

FEATURES:

- **Very low noise:** 0.7dB vhf, 0.8dB uhf
- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW-(*)

MINIATURE GaAs FET PREAMP

ONLY **$24**/kit, **$39** wired/tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*)

IN-LINE PREAMP

ONLY **$79**/kit, **$99** wired/tested

- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

**Specify tuning range: 120-175, 200-240, or 400-500 MHz.*

HELICAL RESONATOR PREAMPS

Preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRA-(*)**, $49 vhf, $94 uhf.

**Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-450, 450-470.*

hamtronics
RECEIVING CONVERTER

RECEIVING CONVERTERS

Low noise converters to **receive vhf and uhf bands on a 10M receiver.** Choice of kit with case & BNC jacks, kit with pcb only, or w/t unit in a case. Other models available for other in/out ranges & atv. *Request catalog for complete listings.*

VHF input ranges avail: 136-138, 144-146, 145-147, 146-148, 220-222, 222-224; kit less case $39, kit w/case $59, w/t in case $89.

UHF input ranges avail: 432-434, 435-437; kit less case $49, kit w/case $69, w/t in case $99.

902-928 MHz converts down to 422-448 or 430-450 range. Same price as uhf.

TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 6M, 2M, 220, 432, 435, and for atv. 1W output. **Kit only $79.** PA's up to 45W available. *Request catalog for complete listings.*

- For complete info, call or write for FREE 40-page catalog.
  Send $2 for overseas air mail. For casual interest, check reader service; allow 3-4 weeks.
- Order by mail, fax, or phone (answering machine off hrs).
- Min. $3 S&H charge for first pound plus add'l weight & ins.
- Use VISA, Mastercard, check, or UPS C.O.D. ($3 fee).

OUR 27TH YEAR!

hamtronics, inc.

65 MOUL RD. - HILTON NY 14468-9535
Phone: 716-392-9430 -- FAX: 716-392-9420

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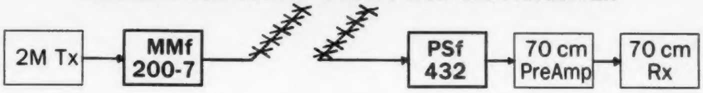
CIRCLE 57 ON READER SERVICE CARD

OSCAR MODE-J FILTERS

PREVENT DESENSE OF YOUR DOWN-LINK RECEIVER



MMf200-7	$55.00	PSf432	$95.00
(usually sufficient)		(for extra protection)	
I.L. @ 145 MHz	0.5dB	I.L. @ 435 MHz	0.1 dB
Loss @ 435 MHz	40 dB min	Loss @ 145 MHz	70 dB typ

Send 75¢ (3 stamps) for detailed specs on all VHF & UHF products. Shipping FOB Concord, MA
PRICES SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

si **SPECTRUM INTERNATIONAL INC.** **(508) 263-2145**
P.O. Box 10845, Concord, MA 01742, USA
MasterCard VISA

CIRCLE 183 ON READER SERVICE CARD

★*QUALITY* PARTS ★*DISCOUNT* PRICES ★*FAST* SHIPPING

ALL ELECTRONICS CORP.

3 to 6 Vdc MOTOR with GEARBOX
Probably designed for childs toy. Lever selects 2 forward and one reverse speed. 1st gear aprox. 120 rpm/6vdc, 2nd gear aprox. 300 rpm/6vdc, Reverse aprox. 120 rpm/6vdc.
3.35" X 1.75" X 3.25"
CAT# DCM-10 $6.00

4 AA BATTERY PACK (USED)
Four AA nickel cadmium batteries connected in series to make a 4.8 volt pack. Batteries are in a 2 X 2 configuration with a 2 pin connector attached. The four batteries can be separated into single AA size solder tab nickel cadmium batteries or resoldered into other configurations.
SPECIAL SALE PRICE - ~~WERE $4.00 per pack~~ NOW $3.00 per pack
CAT# NCB-41AAU

STEPPER MOTOR
Airpax# A82743-M4
Brand new 12 volt dc stepper motor. 35 ohm coil. 7.5 degrees per step. 2.25" diameter, 0.93" long excluding shaft. 0.22" diameter shaft is 0.75" long.2 hole mounting flange, 2.675" mounting centers. 6 wire leads.
CAT# SMT-5
$10.00 each

12 VOLT DC MINI FAN
Howard Industries# 3-15-810. Operates on 12 Vdc, 0.10 amp, 1.0 watt. Compact plastic housing, 0.35" square X 1.275" thick. 9 blade fan. Two 9" pigtail leads.
CAT# CF-121 $9.00 each

115 VAC COOLING FAN
STANDARD SIZE COOLING FAN.
Features die cast metal housing for strength and durability.
IMPEDANCE PROTECTED
4 11/16" square X 1 1/2" deep.
Factory new 120 Vac fans. **CF1-N $9.50 each**

WALL TRANSFORMERS
ALL PLUG DIRECTLY INTO 120 VAC OUTLET
6 Vdc @ 200 ma. CAT# DCTX-[illegible] $2.25
9 Vdc @ 250 ma. CAT# DCTX-[illegible] $2.50
18 Vac @ 1 amp. CAT# ACTX-1[illegible] $3.50
24 Vac @ 625 ma. CAT# ACTX-2462 $[illegible]

LED'S
STANDARD JUMBO DIFFUSED T 1-3/4 size
RED CAT# LED-1 10 for $1.50 • 100 for $13.00
GREEN CAT# LED-2 10 for $2.00 • 100 for $17.00
YELLOW CAT# LED-3 10 for $2.00 • 100 for $17.00

FLASHING LED
with built in flashing circuit operates on 5 volts...
RED $1.00 each
CAT# LED-4 10 for $9.50
GREEN $1.00 each
CAT# LED-4G 10 for $9.50

BI-POLAR LED
Lights RED one direction, GREEN the other. Two leads.
CAT# LED-6 2 for $1.70

LED HOLDER
Two piece holder.
CAT# HLED 10 for 65¢

PHOTO FLASH CAPACITOR
Rubycon# FKX
200 mfd. 330 volts.
0.79" diameter X 1.11" high
Solder loop terminals.
CAT# PPC-200 $3.25 each
10 for $30.00 • 100 for $275.00

PIEZO WARNING DEVICE
Murata Erie # PKB5-4A0
High pitched audible alarm. Operates on 3 - 20 Vdc @ 20 ma. 1" high x 7/8" dia. P.C. board mount.
CAT# PBZ-84 $1.75 each

TIL-99 PHOTO TRANSISTOR
TO-18 case with window. For wide-angle viewing applications. Spectrally and mechanically compatible with TIL-31B. CAT# TIL-99
$1.00 each • 10 for $9.00

TIL-31B PHOTO DIODE
TO-18 case with window. Infrared emiting photo diode. CAT# TIL-31B $1.00 ea. • 10 for $9.50

N-CHANNEL MOSFET
IRF-511 TO-220 case
CAT# IRF 511
$1.00 each • 10 for $9.00
LARGE QUANTITY AVAILABLE

SWITCHES

ITT PUSH BUTTON
ITT MDPL series. 3/4" X 1/2" grey rectangular key cap. S.P.S.T. N.O.
Push to close. RATED: 0.1 amp switching, 0.25 amp carry current. P.C. mount. CAT# PB-6
65¢ each • 10 for $6.00 • 100 for $50.00

10 POSITION MINI-ROTARY
Grayhill# 56P30-01-1-10N-C
Mini rotary switch. Non-shorting. 1 deck, 10 positions. .125" dia. shaft X .375" long. .377" behind the panel depth. P.C. pins.
CAT# MRS-10 WAS $2.50 NOW $1.00 each

SPDT PUSHBUTTON
Marquardt# 1843
Rated 6 amps @ 125/250 Vac.
Black plastic pushbutton.
Switch body: .92" X .94" X .65".
CAT# PB-18 $1.65 each • 10 for $1.50 each

PUSHBUTTON SWITCH
GC/Thomson# 35-420
S.P.S.T., normally open momentary pushbutton switch. Red plastic actuator .57" dia. Chrome bezel .66" diameter. Threaded bushing mounts in .50" diam. chassis hole. Rated 3 amp @ 250 Vac. Solder loop terminals.
CAT# PB-20 $1.00 each

RELAYS

12 VOLT D.C. COIL S.P.D.T.
Omron# G2E-184P 4 Amp contacts
335 ohm coil.
Sugar cube size.
.81" X .42" X .44" high.
P.C. mount with pins on DIP spacing.
CAT# RLY-787 $1.50 each

5-6 VDC SIP REED RELAY
Electrol "Blue Boy"# BBS1A05A10
5-6 Vdc, 500 ohm coil.
S.P.S.T. normally open reed relay.
0.5 amp contacts. SIP configuration.
1" X .375" X .3".
CAT# RRLY-SIP5
$1.10 each • 10 for $10.00

22/44 PIN CONNECTOR
.156" pin spacing, 0.200" between double rows, gold contacts, P.C. mounting.
SPECIAL. Same as AMP# 2-530655-6.
CAT# EBC-1G $1.00 each • 10 for $8.00

0-30 MINUTE AUTO-SHUTOFF TIMER
Sankyo Seiki Mfg.# TMCF35MYB0
120 Vac 60 hz. 10 amp contacts.
UL rated. Turn shaft to turn on lights or other electrical devices.
Bell rings and circuit breaks after specified amount of time. Ideal for any device that needs to shut off automatically. 2.92" X 1.9" X 2.54" behind face plate. 1/4" half-round shaft.
CAT# TMC-30 $3.00 each

LED CHASER KIT
Build this variable speed led chaser. 10 leds flash sequentially at whatever speed you set them for. Easy to build kit includes pc board, parts and instructions. Operates on 3 to 9 volts. PC board is 5" X 2.25". A great one hour project.
CAT# AEC $6.50 each

NICKEL-CAD BATTERIES (RECHARGEABLE)
SPECIAL!! AAA SIZE
Panasonic# P-16AAA
1.2 volt @ 180 MAh
CAT# NCB-AAAX $1.50 each
10 for $13.50 • 100 for $125.00

AA SIZE $2.00 each
1.25 volts 500 mAh
CAT# NCB-AA

AA SIZE $2.20 each
WITH SOLDER TABS
CAT# NCB-SAA

C SIZE $4.25 EACH
1.2 volts 1200 mAh
CAT# NCB-C

D SIZE $4.50 each
1.2 volts 1200 mAh
CAT# NCB-D

L.E.D. FLASHER KIT
Two L.E.D.'s flash in unison when a 9 volt battery is attached. This kit includes a p.c. board, all the parts and instructions to make a simple flasher circuit. A quick and easy project for anyone with basic soldering skills. CAT# LEDKIT $1.75 per kit

TELEPHONE COUPLING TRANSFORMER
Multi Products International# A18N-HO-1D/1
Primary 600 ohm
Secondary: 600/600 ohm
.77" X .61" X .63" high.
6 p.c. pins on .187" centers.
Primary inductance:
300 mH min., at 1kHz, 1 volt.
CAT# TCTX-1 $1.25 each • 10 for $11.00

OPTO SENSOR
U shaped package with mounting ears. 1/8" opening. 3/4" mounting holes. CAT# OSU-8 50¢ each
10 for $4.50 • 100 for $40.00

OPTO ISOLATOR
Sigma# 301T1-12B1. Signal applied to the input is coupled by means of light to isolated photo conductive cell. High reliability switching. 12 volt input.
CAT# OP-301 $1.50 each

LOOK WHAT $1.00 WILL BUY

200 ASSORTED 1/4 WATT RESISTORS
Bent leads, carbon comp. and carbon film.
CAT# GRES $1.00 per assortment

200 ASSORTED 1/2 WATT RESISTORS
Bent leads, carbon comp and carbon film.
CAT# GRABRE $1.00 per assortment

50 ASSORTED DISC CAPACITORS
Most are cut (p.c. leads). Some to 500 volts
CAT# GRABDC $1.00 per assortment

15 VALUES OF ELECTROLYTICS
Contains both axial and radial styles from 1 mfd.
CAT# GRABCP $1.00 per assortment

10 AMP SOLID STATE RELAY
ELECTROL# S2181
CONTROL:
Rated 5.5 to 10 Vdc
(will operate on 3-32 Vdc).
LOAD: 10 amp @ 240 Vac
2 1/4" X 1 3/4" X 7/8"
CAT# SSRLY-10B $9.50 each
QUANTITY DISCOUNT
10 for $85.00 • 25 for $175.00
50 for $300.00 • 100 for $500.00

XENON TUBE
1" long flashtube prepped with 3 1/2" red and black leads. Ideal for electronic flash or strobe projects.
CAT# FLT-3 2 for $1.00

1/4 WATT RESISTOR KIT
Ideal for the workshop, this 1/4 watt resistor kit contains 10 pieces each of 42 of the most popular values (420 pieces total). Includes a divided box and a parts locator.
VALUES in this kit are:
1 ohm, 10 ohm, 39 ohm, 47 ohm, 51 ohm, 68 ohm, 100 ohm, 130 ohm, 150 ohm, 180 ohm, 220 ohm, 330 ohm, 470 ohm, 560 ohm, 680 ohm, 1K, 1.2K, 1.5K, 2K, 2.2K, 2.7K, 3K, 4.7K, 5.1K, 5.6K, 10K, 15K, 22K, 30K, 33K, 39K, 47K, 56K, 68K, 100K, 120K, 150K, 220K, 470K, 1 MEG, 5.1 MEG, 10 MEG
The resistors alone would sell for $21.00.
Complete kit • **CAT# REKIT-14 $17.00**

14.7 VOLT TRANSFORMER
Sprite Industries# CS-510A. 14.7 volt, 60 hz, 8.82 Va.
1.61" high X 1.96" X 1.47". Mounting holes on 2.32" centers.
CAT# TX-147 $3.00 each
10 for $27.00 • 100 for $250.00

A.C. LINE CORDS
Black 6ft., 18/2, spt-2
NON POLARIZED PLUG
CAT# LCAC 2 for $1.00 • 100 for $45.00
POLARIZED PLUG
CAT# LCP-1 60¢ each • 100 for $50.00

TRANSISTORS
ORDER BY PART #

PN2222 NPN	TO-92 5 for 75¢
PN2907 PNP	TO-92 5 for 75¢
2N3055 NPN	TO-3 $1.00 each
MJ2955 PNP	TO-3 $1.50 each
MJE2955T PNP	TO-220 75¢ each
MJE3055T NPN	TO-220 75¢ each
TIP31 NPN	TO-220 75¢ each
TIP32 PNP	TO-220 75¢ each
TIP121 NPN	TO-220 75¢ each
TIP126 PNP	TO-220 75¢ each

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Now 60 pages!

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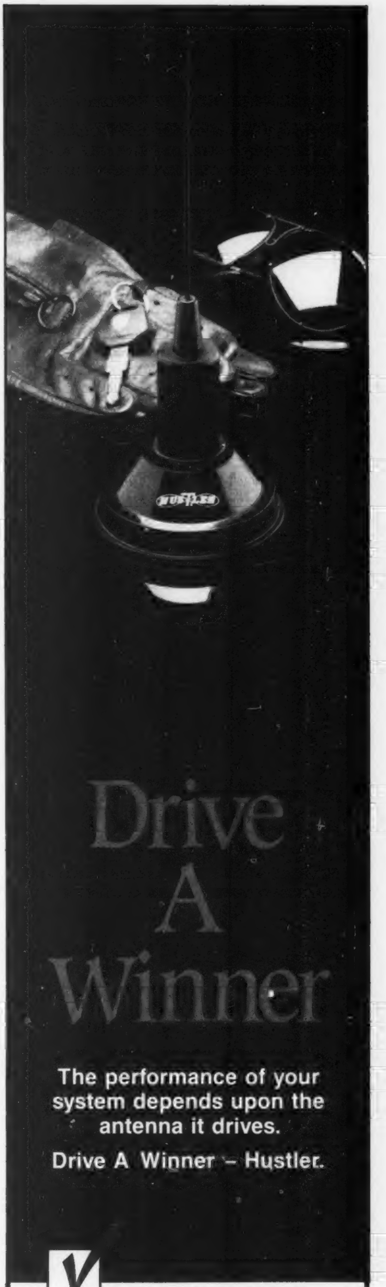
DISCOVER VISA MasterCard

CIRCLE 194 ON READER SERVICE CARD



The performance of your system depends upon the antenna it drives.

Drive A Winner – Hustler.

☑ Yes, please send information on your line of amateur antennas to:

NAME ____________________
ADDRESS ____________________
____
CITY STATE ZIP

HUSTLER®

One Newtronics Place
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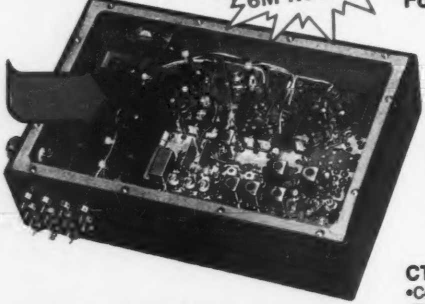
6M RCVRS



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- 'S Meter', Discriminator & Deviation Mtr. Outputs!
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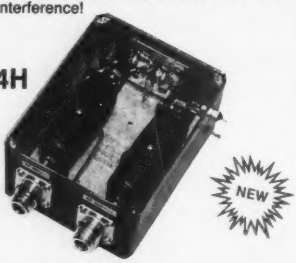
FL-4H



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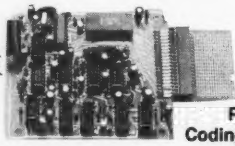
- **SCP12** 12 VDC @ 0.3A MAX. OUT.
- **SCP512** 12 VDC @ 1A & 5VDC @ 0.4A out. (1.1A total max. out.)
- **SCP512A** As above, but also w/−12VDC @ 0.1A

NEW



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- Low Power Consumption CMOS Technology. 5VDC Input. Gold-plated connectors.

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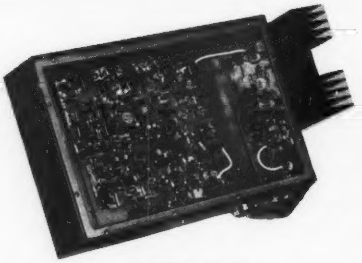
SCP 30
POWER SUPPLY

NEW

SCP30 HEAVY DUTY 30 AMP RACK MT. POWER SUPPLY

- 13.8 VDC out. 115/230 in, 50/60 Hz.
- 30A @ 70% duty, 25A @ 100% duty.
- Massive 30 lb. Transformer & Heat Sinks.



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SCT110 VHF Xmtr/Exciter Board

- **10 Wts. Output. 100% Duty Cycle!**
- Withstands High VSWR
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- Designed specificially for continuous rptr. service. Very low in "white noise."
- Spurious – 75 dB. Harmonics – 60 dB.
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- **BA-30 30 Wt. Amp board & Heat sink,** 3 sec. L.P. filter & rel. pwr. sensor.
- **BA75 75 Wt. unit also available**

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- ***SCT110 mounted in shielded housing***
- Same as used on SCR 1000 & 2000X
- Completely assmbld. w/F.T. caps, SO239 conn.
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- Similar to SCT110, 10 Wts. nom.
- ***Includes "on board" proportional Xtal Osc./Oven circuitry for very high stability!***
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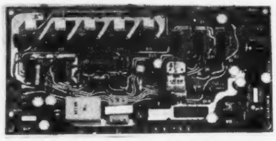

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- Secure 3 Digit Access; 1 Aux On-Off function, Audio AGC; Built-in timers; etc. Beautiful Audio!
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CIRCLE 51 ON READER SERVICE CARD

Color SSTV for the Atari ST—Part II

Cheapskate's way into the fascinating world of color SSTV.

by John W. Langner WB2OSZ

In Part I, we went into a little bit of the history and the basics of slow-scan television, and described how to build a low cost SSTV interface for the Atari ST. In Part II, I show you how to build a high performance interface for a still-modest amount of money.

Upgrading

Figure 8 shows the station configuration for the high performance interface. The program also supports this interface, which connects to the MIDI port (see the block diagram in Figure 9). MIDI stands for Musical Instrument Digital Interface, a standard for connecting computers and electronic musical instruments. The MIDI port is simply a serial interface similar to an RS-232 modem port. However, MIDI is permanently configured for 8 bits per character, no parity, one-stop bit, and 31250 baud. It also uses a current loop rather than a bipolar voltage. A MIDI port is available as an option for most home computers. It is standard equipment on the Atari ST.

The demodulator converts the received audio to a video signal of 0 volts (black) to 5 volts (white), and a positive TTL-compatible sync signal. I took this part from an earlier design in "Color Computer SSTV," by K6AEP and WB8DQT, Parts I and II, in the November and December 1984 issues of *73*. These articles are also in the ESF reprint booklet 103 (for the address, see reference 4 at the end of this article).

I was not pleased with the performance and made some modifications. First, the low-pass filter had a cut-off frequency of about 250 Hz, so details were lost. I tinkered with component values to get a fairly flat response out to about 900 Hz (see W9NTP and WB8DQT's *Slow-Scan Television Handbook*, Chapter 1 published by *73* in 1975) and a sharp cut-off above that. Second, the AC coupling in the sync circuit did not accurately preserve the length of vertical sync pulses, so I made it DC-coupled. The modified schematic is in Figure 10. Other SSTV demodulators with compatible outputs would also be suitable.[6] Figures 11 and 12 contain the rest of the high performance interface. The computer sends bytes to the interface through J1 at the desired pixel sampling rate. Each time the UART (U2) receives a byte, it commands the A/D converter (U3) to begin a conversion. A video signal of 0 to 5 volts is converted to an eight-bit number in the range of 0 to 255. The UART converts this to serial form and sends the sample value to the computer through J2.

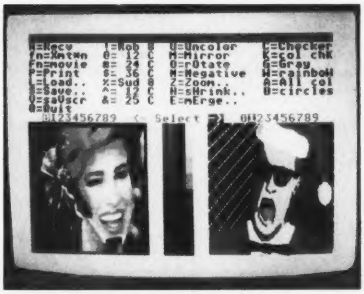

Photo C. Atari ST SSTV images.

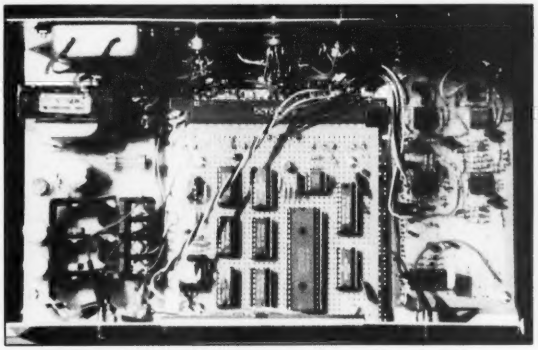

Photo D. High-performance interface layout.

Note the jumper connected to the least significant bit (pin 26) of U2. In the current version, this bit is used for the sync signal from the demodulator. I plan in a future version to try using the full 8 bits to represent a tone in the range of 1000 to 2400 Hz, and perform sync detection in software. This would allow automatic compensation for slightly mistuned signals, and decoding of the format information in the vertical sync of the Robot formats.

See Figure 12. The tone generator produces a crystal controlled, phase coherent sine wave and requires no adjustment. U4 and U5 are a programmable divide-by-*n* counter. U6, U7, and R10–R12 produce an approximation of a sine wave. The output frequency is 250,000/(256-*n*), where *n* is the data from the computer. When the two most significant bits are ones, the tone generator is turned off. When in transmit mode, the relay (K1) turns on the transmitter and substitutes the tone generator for the microphone.

Adjustment

The demodulator must be adjusted to produce the proper mapping of frequency to voltage. Many construction articles simply instruct you to whip out your audio signal generator, digital frequency counter, digital voltmeter, etc., and fiddle with the pots until it's right. Many hams don't have all this fancy test equipment, however, so I wrote a program called HPITEST. During adjustment, the output from the tone generator is connected to the demodulator input. The computer sweeps the tone generator output across the range of about 1000 to 2400 Hz and plots the output on the screen.

Signal Analyzer

Some people can tune in RTTY and packet signals very accurately by ear, but most, myself included, can't do this. Tuning doesn't seem to be as critical for SSTV, but a visual tuning aid still helps. The optional signal analyzer/tuning indicator (see Figure 13) has a 20-segment LED display, each segment corresponding to a frequency range of about 70 or 80 Hz.

The HPITEST program has another option for calibrating this display. While the computer is rapidly cycling the tone generator between 1200, 1500, and 2300 Hz, the pots are user-adjusted to position the dots in the desired locations. A properly tuned signal appears as a big blur in the 1500 to 2300 Hz range (depending on the particular pic-

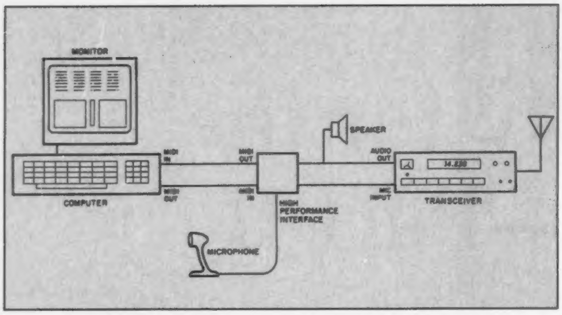
MONITOR
SPEAKER
COMPUTER
MIDI IN
MIDI OUT
MIDI OUT
MIDI IN
HIGH PERFORMANCE INTERFACE
AUDIO OUT
MIC INPUT
14.230
TRANSCEIVER
MICROPHONE

Figure 8. Station layout using the high-performance interface.

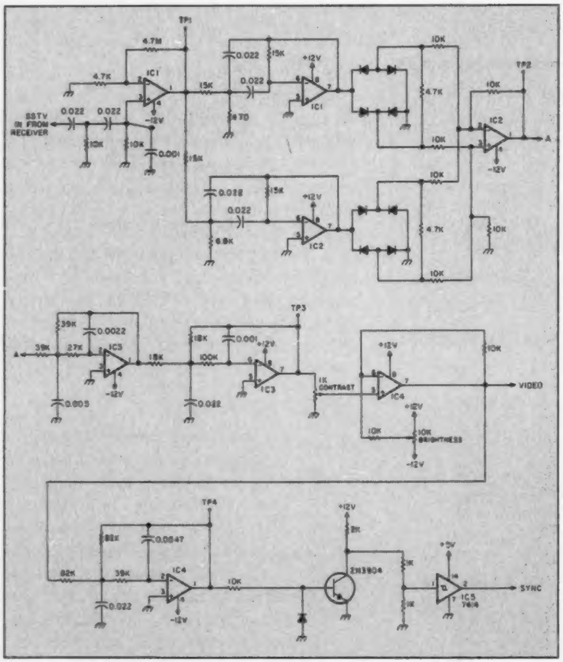
TP1
TP2
TP3
TP4
SSTV IN FROM RECEIVER
IC1
IC2
IC3
IC4
IC5
+12V
-12V
1K CONTRAST
10K BRIGHTNESS
VIDEO
2N3904
7414
SYNC
A

Figure 10. Modifications to the schematic in the "Color Computer SSTV," article by K6AEP and WB8DQT, Parts I and II, in the November and December 1984 issues of 73. This is the demodulator for the high-performance interface.

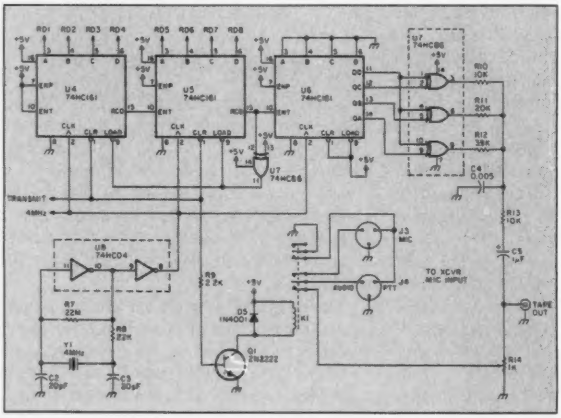
RD1
RD2
RD3
RD4
RD5
RD6
RD7
RD8
U4 74HC161
U5 74HC161
U6 74HC161
U7 74HC86
U8 74HC04
TRANSMIT
4MHz
Y1 4MHz
J3 MIC
J4 PTT
TO XCVR MIC INPUT
TAPE OUT
K1
D5 1N4001
Q1 2N2222

Figure 12. Schematic containing tone generation for the high performance interface.

ture), and as a separate sync dot at 1200 Hz.

Obtaining Software

A free demo version of the software, with slightly reduced functionality, is available from *Atari Microcomputer Network, John Adams KC5FW, 17106 Happy Hollow, San Antonio TX 78232* (send formatted disk and $2), and from *ASTUR (Atari ST Users on Radio), GEERAERT Michel, W. Elsschotlann 21, B-8460 Koksijde, BELGIUM* (send two disks and three IRCs. One disk will be returned to you).

This version can send and receive (both color and black & white), load pictures from files, print, manipulate images, and generate test patterns. But, its few limitations and annoyances are enough to encourage frequent users to upgrade to the most recent full version. The full version is included with the kit from A&A Engineering (see Table 4).

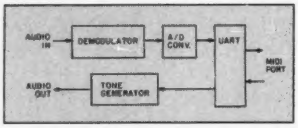
AUDIO IN
DEMODULATOR
A/D CONV.
UART
MIDI PORT
AUDIO OUT
TONE GENERATOR

Figure 9. Block diagram of high performance interface.

Conclusion

This approach is not a state of the art system, but it's a great way to try a new mode of communication with very little investment. The total cost for the low-cost system, featured in Part I, is only about $10 for the interface (depending on what's in the junkbox) and demo version of the software. See the address for A&A below for the kit cost for the high performance version.

For more information on SSTV and ham radio applications for Atari computers, tune in to the nets and subscribe to the publications in the sidebar listed in Part I.

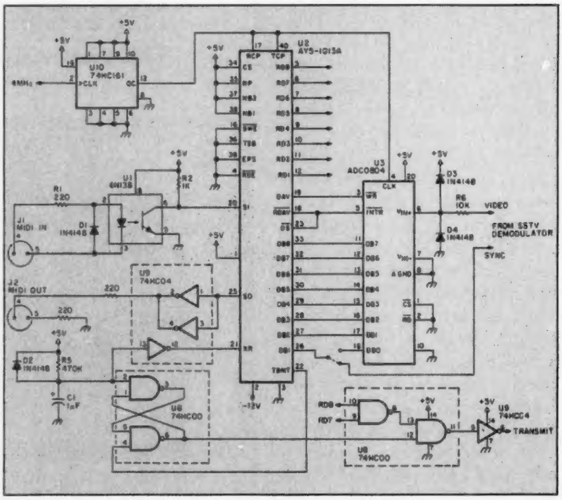
U10 74HC161
4MHz
U2 AY5-1013A
U1 6N138
J1 MIDI IN
J2 MIDI OUT
U9 74HC04
U8 74HC00
U3 ADC0804
D3 1N4148
D4 1N4148
VIDEO FROM SSTV DEMODULATOR
SYNC
TRANSMIT

Figure 11. Schematic for the UART and A/D portion of the high performance interface.

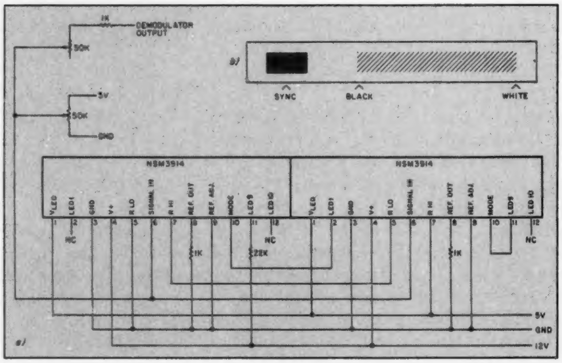
DEMODULATOR OUTPUT
1K
50K
5V
GND
b)
SYNC
BLACK
WHITE
NSM3914
NSM3914
a)
5V
GND
12V

Figure 13. Visual signal tuning aid. a) shows the schematic, and b) is a diagram of the LED display.

References

[4] Suding, Robert W0LMD, "8 and 12 second single-frame color SSTV." *The Best of A5—Slow Scan Television*, page 34. (Reprint booklet number 103 from ESF Copy Services, 4011 Clearview Drive, Cedar Falls IA 50613. $10 plus $1 postage.) Suding formats are not commonly used now.

[6] Schick, Martin K. KA4IWG, "Color SSTV and the Atari Computer." *QST*, August 1985. ■

Table 4.
Parts List for High Performance Interface
(excluding demodulator and power supply)

C1,C5	1 µF electrolytic
C2,C3	20 pF mica
C4	0.005 µF mylar
C6-C9	0.[illegible]F disc (5 V to ground)
D1-D4	1[illegible]48
D5	1N4001
J1,J2	5-pin DIN female socket
J3,J4	mike connector of your choice
K1	5V DPDT relay
Q1	2N2222
R1,R3,R4	220Ω
R2	1 k
R5	470 k
R6,R10,R13	10 k
R7	22 M
R8	22 k
R9	2.2 k
R11	20 k
R12	39 k
R14	5 k pot
U1	6N138 optoisolator
U2	AY-5-1013A UART or COM 8017P (pin compatible but does not require −12V)
U3	ADC0804 A/D converter
U4–U6,U10	74HC161 4 bit counter
U7	74HC86 quad exclusive OR
U8	74HC00 quad NAND gate
U9	74HC04 hex inverter
Y1	4 MHz crystal
Misc. Items:	cabinet
	power cord
	power switch
	IC sockets
	prototype board
	5-pin DIN cables (RS 42-2151)

A pair of kits, for the SSTV circuit and a visual voltmeter, are available from A & A Engineering, 2521 W. La Palma, Unit K, Anaheim CA 92801; PH: (714) 952-2114. The visual voltmeter is used for the tuning indicator:

Both circuit boards only #168/169-PCB	$24.95
Both kits w/ circuit boards and program #168/169-KIT	$124.95
Boards tested and assembled and program #168/169-ASY	$149.95
Program only #168-PGM	$25.00

Complete kits include PC boards, all components, DIN connectors, and software. They do not include cabinets, microphone connectors, or cables. The kit requires only a +12V supply, so most people can use their transceiver power supplies.

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- Automatically erases memory and rapid charges any Nicad battery up to 15 volts.
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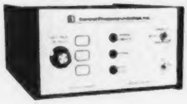
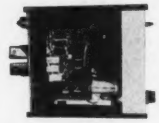

GMS 403
(3 Program Slots)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(Top Inside View)

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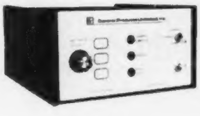
GMS 403A
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PREAMP
6
12
RX MIX
MONI
MAIN
SUB
LSB
USB
CW
AM
FM
RTTY
PKT
MAIN
VFO A
RX
FAST
MIC
RF PWR
PROC
DRIVE
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VFO-MEM

features and options that other manufacturers still have on their drawing boards: Like **200 watts RF power output; Built-in TCXO,** for superior frequency stability; **Independent filter selection; Dual receive with balance control** and **two tuning knobs** for simultaneous reception in tough pile-up situations. Using **BPF-1** allows cross-band dual receive.

And the FT-1000 options such as **digital voice-recording system (DVS-2)** for storing and playback "CQ Contest" messages. On RX the DVS-2 has a 16-second running memory for playing back garbled calls. There's also a **CW spot control,** so you can align your frequency to that of an incoming signal without having to transmit; Plus **direct keyboard frequency entry; Front panel RX antenna selector; Built-in cascaded filters;** Dual mode noise blanker. And the receiver front-end uses a four JFET up-conversion mixer, for high dynamic range.

This HF rig is the product of three years of intensive research and design. These efforts show in Yaesu's scrupulous attention to detail with features and options ergonomically designed to allow you to achieve a position of competitive dominance. To hear and be heard… Like never before.

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New DX Column!

Greetings from your new DX editor. Writing about the DX scene is not new to me, as I have been editing a weekly DX bulletin, *QRZ DX,* since 1983. I've been an active DXer since 1976. I've worked 291 countries, all CQ zones, and I've participated in several DXpeditions and contest operations.

My DX operations include VK9YW and XE0KNE in 1987. I was one of the operators at CY9DXX in 1988 and CY0DXX in 1989. My other hobby is photography, and I enjoy showing my DXpedition slides at DX gatherings around the country. I'm looking forward to editing this column, and I'm open to suggestions about the content. What would you like to see?

Bouvet Island DXpedition

After almost a decade of silence, Bouvet Island had climbed to the top of the most-wanted list for the majority of DXers. The first operation, by Gus Browning W4BPD as LH4C in 1962, did little to whet the voracious appetite of DXers around the world. Subsequent operations by LA5DQ and LA1VC, who signed 3Y5DQ and 3Y1VC, respectively, during the 1970s, did not completely satisfy the need either.

The announcements of DXpeditions to Bouvet Island by Club Bouvet and the Legion of Indianapolis DXers late last year were welcome indeed. Club Bouvet, represented by Einar LA1EE, Kaare LA2GV, and Erling LA6VM, was scheduled to activate the island during this past Christmas/New Year season, but since this column is being written in October, the outcome of their operation is not known.

Coming Soon

In late September, the Legion of Indianapolis DXers announced their own Bouvet Island DXpedition, scheduled to begin operation on February 2, 1990. This announcement culminated almost 2 years of development, planning, and negotiations. The Saturday Evening Post Society and the *Saturday Evening Post Magazine* of Indianapolis is partially sponsoring and organizing the effort. The total cost of the expedition, expected to be around $120,000, is funded by private corporate interests and landing team members. Participants in this combination scientific/amateur radio expedition include the National Geographic Society and numerous universities.

The amateur radio group plans to land 12 radio operators and operate seven stations during a 10–12 day stay on the island. The list of operators includes Tom N9AZD, Rusty W6OAT, Bill KA9AND, Mike W9SU (expedition director), Jay WB9LTY, Mike NE9O, Chip K7JA, Mike WA9NPM, Al WB9QPN, Jim WB9CEP, Brian KA9OIH, Mike W9RE, and Martti OH2BH.

All operations from the island will be conducted with the call-sign 3Y0B.

During amateur radio maritime mobile operations, the call-sign 3Y0B/MM Region 1 will be used. QSLs will be handled by WA9VGY.

See the table for suggested frequencies in transmit/receive format.

An Adventure to Visit

The 1,387 nautical mile voyage to the island will be aboard the *Deep Salvage I* of Capetown, Republic of South Africa. *Deep Salvage I,* a maintenance and salvage vessel, is 184 feet long and 31 feet wide.

The five-and-a-half day voyage to the island is scheduled to begin on January 25, with arrival on January 31. The next day, the landing team will leave in small inflatable craft to go ashore.

Bouvet Island is one of the most isolated and inhospitable islands in the world. High cliffs surround most of its coastline, and an extensive glacier covers the plateau at its highest point. Gus W4BPD, in the October 1967 issue of *73 Magazine,* described the island as resembling "...a very large chocolate cake with white frosting on its top side."

Suggested Frequencies
Transmit/Receive

Band	SSB	CW	RTTY
160	none	1825/1835+	none
80/75	3695/3800+	3505/3525+	none
40	7055/7200+	7005/7025+	none
30	none	10105/10125+	none
20	14145/14200+	14005/14025+	14088/14090+
17	none	18070/18080+	none
15	21195/21300+	21005/21025+	21088/21090+
12	none	24905/24925+	none
10	28295/28450+	28005/28025+	28088/28090+

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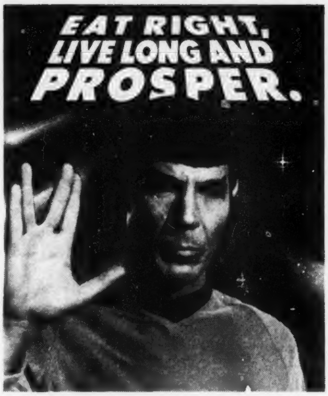

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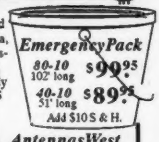

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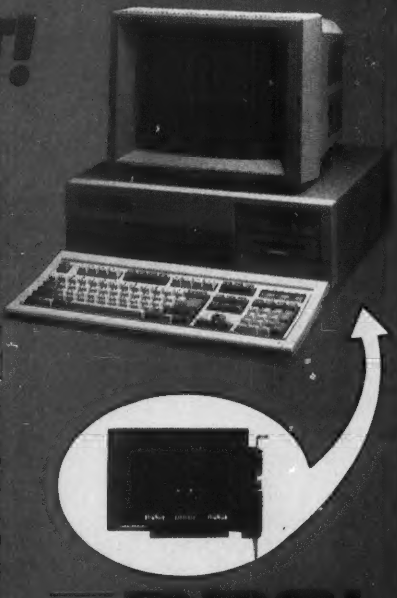

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Z Matching, O'scopes, and Other Matters

A few words before delving into this month's topic. Folks have been writing in, and I'd like to ask a favor regarding correspondence: Please DON'T send a self-addressed stamped envelope in expectation of a reply. Although I occasionally do try to help via return mail, it's usually not possible. I'll do my best to get topical letters into the column.

This month's column focuses on troubleshooting modern solid state gear. Along with that goes some background on basic electronics and test equipment. I can't be of much help with tube rigs and amplifiers, tuners, feedlines, etc. Also, I'm not the one to contact regarding antenna matters, as I'm no expert on skyhooks and (gasp!) don't even like the things. Please refer antenna questions to *73*.

Matchmaker, Matchmaker

Howard WB0IWN wrote asking that I discuss impedance matching and efficient power transfer. Why does a matched impedance result in the greatest efficiency?

Lots of arcane math will prove the point, but it's easier to explain using common sense and a basic understanding of Ohm's law. When we talk of power transfer, we mean it in the literal sense: transfer of watts, not volts or amps alone. Power (watts) is the product of current (amps) and voltage. If you have, say, ten watts of power, it could be 5 volts at 2 amps, 20 volts at ½ amp, or 1 volt at 10 amps. Any way you slice it, it's still 10 watts.

Since power is amps times volts, the maximum power will be transferred when the maximum current flowing through the load coincides with the maximum voltage across it. If you've ever played with a battery or a power supply, you know that there is a limit to what it can deliver. After all, it is a finite source of energy, so it's got to give up at some point. When you try to pull too much current from it by connecting it to a load with a very low resistance, its voltage begins to drop, even while it's giving all the current it can. The battery's own internal resistance (everything has some) forces the voltage down, because it is significant compared to the very low load resistance. Try drawing a circuit with a battery, a resistor in series with it, and then another in series with that. The first resistor is the battery's internal resistance, and the second is the load. If the first is one ohm and the second is 100 ohms, you can see that there won't be much voltage drop across the one ohm resistor. If, however, the load is ½ ohm, then the one ohm resistor will cut the voltage going to the load down quite a bit.

So, if the source resistance is greater than the load resistance, the voltage across the load will drop, even though the current will be at maximum. But what about the other way around? If the load resistance is higher than the source, the voltage will be fine but not all the current available from the source will be flowing into the load. Either condition results in less than optimum transfer of watts from the source to the load. When the resistances are matched, however, the voltage drops across the source and load resistances will be equal. The maximum current that can flow, without dropping more voltage at the source than at the load, will be flowing. In other words, the most watts will be transferred. AC impedance, of course, is a more complicated phenomenon, but the basic idea is the same: to maximize the voltage across, and current flowing through, the load. That's why a 50 ohm transmitter output delivers the most power to a 50 ohm antenna, and a 600 ohm mike works poorly into a 50,000 ohm mike input.

> ***"Power (watts) is the product of current (amps) and voltage."***

Whew! Compared to that, the next topic will be easy.

I Can See!

In previous columns, I've mentioned that the oscilloscope is a very powerful troubleshooting tool. Undoubtedly, you've seen other references to scopes, too. But with all those knobs and dials, they must be very hard to use, right? And they must cost a fortune, too. They're for laboratory scientists, not for you, right?

Hah! Don't believe it. The truth is, scopes are easy to use, and you can probably find a decent one for little money at the next hamfest. But what the heck does a scope really do?

A scope is a fast electronic graphing machine. It displays a simple graph of voltage over a period of time. The spot on the screen sweeps from left to right, over and over again, and moves up and down in relation to a changing voltage coming from the circuit being tested. It's just like the X and Y coordinates of a paper graph, only faster.

Your scope lets you eavesdrop on any point in a circuit. Working without one is like painting blindfolded—it can be done, but it's hard. Detailed interpretation of the scope's display is an acquired skill, but getting familiar with the basics of scope operation shouldn't take more than an evening or two.

The controls on most scopes are grouped according to their functions. Near the screen, you will find adjustments for brightness and focus. Near the input jacks (where you connect the signals to be displayed) are controls which size the vertical motions to make them fit the screen. Another group of controls sets the time it takes for the beam to sweep across the screen. Along with these are adjustments for the trigger, which makes the beam begin sweeping at a consistent point along the input waveform, to provide a stable display.

You can use your scope for measurement as well as simple display. The sweep speed and vertical amplitude controls are calibrated with respect to the little boxes (called the "graticule") painted on the screen. If your vertical input is set for 2 volts per division, and the beam deflects 3 divisions when you connect your input signal, then you have measured 6 volts! It's that simple. If a square wave signal requires 4 boxes for an entire cycle (from left to right), and your sweep speed is set to 3 milliseconds per division, then the wave has a period of 12 milliseconds. To get the frequency, just divide 1 by the period. In this case, the answer is about 83 cycles per second. It's important to note that, in general, scopes do not offer the precision and accuracy associated with frequency counters and digital multimeters. The scopes typically have error specs ranging from ±3% on up to ±10%. But they allow measurement within complex waveforms, something no other instrument can offer.

Picking One

Scopes come in many varieties and price levels. Although some laboratory instruments (especially those with digital storage capabilities) can cost thousands of dollars, there are plenty of low-cost units from which to choose. The first step, as with any equipment purchase, is to evaluate your needs.

The most important price determinant is bandwidth. How fast will the signals you want to display or measure be? The bandwidth is specified in megahertz (MHz). A low-cost unit may have only a 5 MHz bandwidth, which can be quite limiting in radio work. With such a unit, you wouldn't, for example, be able to see the 10.7 MHz IF signal in an FM receiver. Nor would you be able to see the output of a 10 meter rig. A better choice would be a 25 or 40 MHz bandwidth, which would cover most frequencies of interest. Such scopes can be had new for around $500.

Many mid-priced scopes have dual trace capability. This function lets you view two signals at once so that you can examine the relationships between them. It's very handy for working on circuits which involve feedback loops because you can see causes and results at the same time. For much general troubleshooting work, though, you can do without it.

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triggered sweep. That is, they withhold the sweep until triggered by the incoming signal. It's a very important function; avoid the older "recurrent" type scopes which require manual sweep synchronization.

Advanced scopes offer a delayed sweep function. This lets you pick any point on the incoming waveform and expand it to fill the screen, even if it is not the point from which the sweep was triggered. It's very useful for video and digital work, but has little use for most radio applications, where the signal is very repetitive.

Very advanced scopes have digital functions like waveform storage and numerical measurement. With such units, you can "grab" a signal, examine it, perform precise measurements of voltage and time on any part of it, and even, in some cases, save it on a computer disk! Such instruments are generally out of our price range, and most of the time we don't need them anyway.

Making the Buy

There are lots of mid-priced scopes advertised in the ham and general electronics magazines. They are all solid state (except, of course, for the cathode ray tube). If you can afford a new one, buy it. That way you'll be guaranteed years of trouble-free operation. After all, if your scope quits, you won't have a scope with which to fix it!

You can find good scopes at hamfests, but be careful. Avoid old tube units. Most of them are more than 20 years old, and they are likely to have problems. Look instead for a smaller solid state scope. If at all possible, find an electrical outlet and plug it in. The trace should be well focused, and the sweep should be straight and clean when the vertical input control is turned to its least sensitive position. Try turning the sweep speed down in the millisecond range and touching the input connector with a screwdriver or piece of wire. You should see an AC waveform that looks somewhat like a sinewave, although it may have various wiggles in it. At least you'll know that the vertical amplifiers are working.

If you do wind up having to fix your scope, be especially careful, as very high voltages are used to drive the CRT. Approach a scope as you would a television set.

Expect to pay $50–$300 for a good used scope, depending on its capabilities. It's helpful to know the approximate value of a new, similar model, so read the ads before you go. You don't want to pay $300 for a 20 MHz unit when you could get a brand new one for $350.

Now, let's look at some letters.

Dear Kaboom,

I just installed an ICOM IC-228H 2 meter rig in my car. The manual says "never use or store at a temperature below +14 degrees F." I live in Vermont, so I'm worried. Will this rig survive the winter?

Signed,
Brrrr

Dear Brrrr,

Manufacturers go to great lengths to present their products in the best possible light. So, when they inform you of a limitation, you'd best believe it! Low-temperature limitations are usually the result of characteristics of some of the materials used in the radio. The problem could be as simple as brittle plastic, or as serious as ruined crystals or LCDs. I'd take that rig in during brutal weather, or get another radio more suited to your climate.

Dear Kaboom,

My Yaesu FT-757GX was recently repaired, after experiencing a problem with sideband selection. Now I get a terrible SWR on 10 meters in my car, even though other rigs connected to the same antenna show a 1:1 match! The '757 works fine in the shack, and I can cure the mobile problem by adding lots of coax to the antenna system. But it used to work. What gives?

Signed,
Mystery Box

Dear Mystery,

This is an obscure one, all right. I'd guess that something in the rig's output filter for 10 meters is broken, and the unlucky combination of its incorrect reactance and the length of your mobile coax is doing you in. If it used to work and now doesn't, it's gotta be broken. Send it back to Yaesu and tell them it started when you got it back.

Have a tech question? Send it off to "Dear Kaboom" at the above address.

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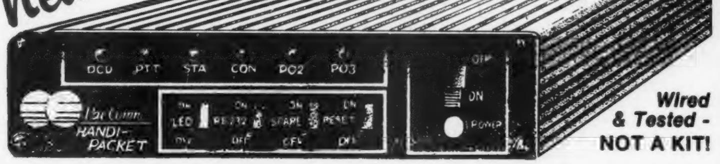

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Thirty Meter QRP Transmitter

Thirty meters is a grand band for working QRP. In fact, I was on 30 meters the other night working quite a few stations with 3 watts from the Argosy. I also worked a station running 1 watt, crystal controlled. He had such a fine-sounding signal, I decided to give the 30 meter band a crack with a homebrew transmitter.

Tracking down a good, workable 30 meter transmitter turned out to be rather easy. I wanted something simple, easy to tune, and requiring no special parts. The result is shown in Figure 1. Only three active devices are used. As a matter of fact, you might have seen the basic schematic before. It is a well thought-out circuit. Not much can go wrong.

Let's take a closer look. The oscillator is crystal controlled. A variable capacitor and coil form a simple network to "warp" the crystal's frequency a bit. Depending on the crystal, you should be able to get about 2 to 4 kHz worth of frequency spread. I've had some rocks that really moved for me, and others that were, well, "rock solid."

The Oscillator

The oscillator transistor is a 2N2222 (what else!). Notice the 8 volt zener diode on the base of the transistor. This supplies a regulated voltage for the oscillator. The 60 pF trimmer across T1 tunes the circuit to resonance. This trimmer will provide a nice peak in output power. The PA transistor is quite common. You can get by with just about anything, provided you keep somewhat close to the specifications of the 2N3553. A 2N3866 will work as well, as will most PA transistors from defunct CBs.

The resistor across the 3-turn link of T1 swamps the input to the PA transistor. Depending on the final you decide to use, you may not have to use R1. Or you might just want to increase the value a little. If the final runs away, you can reduce the value of R1 to settle the final down.

Two output filters are shown. One is a simple, single stage circuit, and the other is a dual filter (see Figure 2). I used the dual filter for better harmonic attenuation. Remember that just because RF power is low, it doesn't give you the right to send out a dirty signal.

The crystal should be an AT cut, HC25U case style, 30 pF loading type. This will allow for maximum amount of VXO swing. You could, of course, use the older FT-243 style of crystal, but you won't get much, if any, VXO swing out of the crystal. I bought my 10.100 MHz crystal from *Crystek Crystals, PO Box 06135, Ft. Myers, Florida, 33906-6135; (800)-237-3061.*

The VXO can only raise, not lower, the frequency. The 10.1 MHz rock should give control up to 10.104 or so. A second crystal, a bit higher, would give almost 100 percent coverage of the most popular frequencies. I only had one rock, and therefore did not worry about frequency switching. You could use a rotary switch and select between different crystals, or as I will do later, use a relay and select between only two crystals. If you opt for a selector switch, just make the connections to the crystals as short as possible.

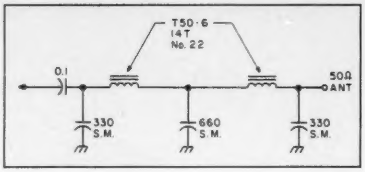

Figure 2. Alternative low-pass filter for greater attenuation of harmonics.

In Figure 1, see the three points marked X, Y, and Z (above and to the lower left of 2N4036). Depending on how you configure these three points, operation will be slightly different. By connecting points X and Z, the oscillator will be keyed along with the final. Connect points X and Y, and the oscillator will run all the time. Use these points if you have a chirpy crystal (i.e. a crystal that doesn't key on and off rapidly) or want to operate a direct conversion receiver from the oscillator. This little circuit should work up to 10 meters, at which point it would be best to leave the oscillator running all the time and just key the final. Otherwise, connect point Z to X for normal operation.

The DC switch transistor supplies 12 volts to the final and to the relay control. Next month we'll discuss the relay control. The transmitter will key by taking the KEY line (lower right of schematic) and pulling it to ground. The 0.1 µF caps add a bit of shaping to the CW envelope, to help avoid key clicks.

I built my version on copper-coated Radio Shack perfboard. You can change some values and still end up with a working unit. You can use a 9.1 volt zener diode in place of the 8 volt unit, and almost any NPN transistor for the oscillator. The DC switch should be capable of handling the current for the final, and the 2N4036 does a very good job. Don't use a leaky, out of spec junk box device for the 2N4036.

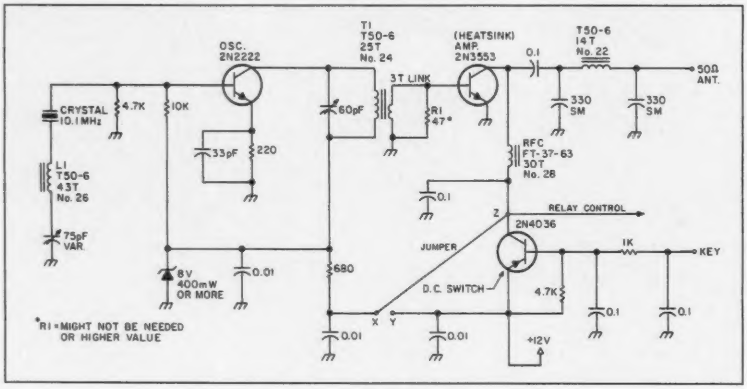

Figure 1. Schematic for the 30m QRP transmitter.

Tuning Up

This requires only a receiver, a crystal, and a wattmeter. Turn the receiver on, tuned to the crystal's frequency. After checking your work, apply power to the transmitter. With the output terminated into a dummy load, key the transmitter. Tune the trimmer capacitor in the oscillator for the best combo of maximum power and good sounding tone. Depending on the crystal, final transistor chosen, and the supply voltage, you should be able to get anywhere from 1 to almost 3 watts of RF out of the transmitter. Tune the VXO. Notice the frequency change as you move the VXO capacitor.

That's about all there is to it! You'll find thirty meters a great band for working QRP. I use my Yaesu FRG-7 receiver and the transmitter for 30 meters. While the FRG-7 is no gleaming bandit on 30, the setup works quite well.

To "spot" the transmitter so I could find the frequency on the FRG-7, I connected a momentary DPST switch between points X and Y. You want to wire the switch to remove power from the PA while supplying it to the oscillator. A diode, 1N4001, in place of the jumper between points X and Y, with a simple SPST switch, should work as well. At least, as long as you keep the VCC from the PA when you operate the spot switch. This will turn on the oscillator without turning on the final. Therefore, you can find the crystal's frequency without causing QRM on the band.

Next month I'll have QSK and sidetone circuits working on a 30 meter receiver converter.

With all these quartz-locked transmitters walking about, buying crystals may run into a bit of money if you order them through crystal dealers (as opposed to buying them at hamfests). Even then they are sometimes hard to find in the value you want.

Customizing Surplus Crystals

There are several options, though. You could always build a VFO, and if you do, be sure to send the schematic, PCB foil diagram, and parts placement diagram to me so the rest of us can benefit. Grinding a crystal, however, may be the fastest way to go. The war surplus crystals in the FT-243 cases can be found just about anywhere. Prices range from nickels and dimes to dollars. If you find an FT-243 rock close to the frequency but lower than what you wanted, you're in luck! Grinding crystals raises their frequency.

You can easily find what you need to custom-make those surplus crystals. You'll need an abrasive, such as Comet cleanser or baking soda; a frequency counter or general coverage receiver; some alcohol and Q-tips; a sheet of glass; and a test circuit to check the frequency of the crystal.

Check the frequency of the crystal first. Make sure you wash your hands to remove excess body oil. After you determine the frequency of the crystal, remove the three screws holding the case together, and open it up.

The crystal looks like a piece of frosted glass. Remove it very carefully. Next, take a piece of glass and lay it flat on the table. Pour about half a teaspoon of the abrasive onto the glass, and add some water to make a wet paste.

Place the crystal in the paste. Using a figure-eight grinding motion, make about five circles while pressing down slightly on the crystal.

Clean the crystal with some alcohol and pat it dry, being careful not to touch the face of the crystal with your fingers. Reassemble the crystal into the holder. Insert the crystal into your oscillator test circuit and measure the frequency. If too low, take it apart and repeat the grinding operation, then test it again. Using this method, you should be able to get within a few cycles of what you want.

If you overshoot and grind off too much, you can slow the crystal down by running a number 2 pencil across its face. Don't over do it! Too much lead and you'll ruin the crystal.

Grinding your own crystals can be a lot of fun. Now there's no reason for not building the 30 meter transmitter in this month's QRP column.

Hot Water Handbook

Still looking for mods for the third edition of the *Hot Water Handbook*, especially for the HW-9. If you're modifying the HW-9, send your creation to me. If I use it, I'll send you a free copy of the new book.

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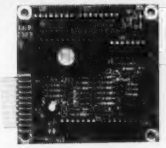

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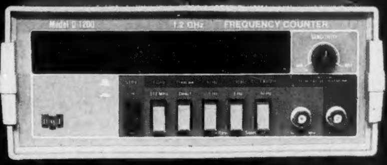

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Secrets of Success on Six

Last month I told you why 6 meters is an excellent band for T-hunts. Surplus equipment is inexpensive. You may already have a scanner that covers the band. I showed how to build a simple loop antenna, as used successfully by several hunters in the monthly hunts on 50.3 MHz FM sponsored by the Southern California Six Meter Club (SCSMC). This month I'll tell you about "secret weapons" that advanced 6-meter hunters use.

The SuperDF on Six

The Super DF by BMG Electronics, reviewed in *Homing In* last November, has the advantage of being a very wideband system. Connected to an extended range FM scanner, such as the Regency MX-7000, it can hunt over a wide frequency range without retuning. Antennas do not have to be resonant for proper RDF operation.

The SuperDF VHF antenna set, with 18-½" whips spaced 22-½" apart, is specified to work down to 50 MHz. It works fine on 2 meters, but it doesn't generate enough DF tone on 6 meters. I couldn't get good bearings with it, so I built another antenna unit especially for 6, with longer elements spaced 48" apart. It worked much better.

If you wish to build a 6 meter antenna set for your SuperDF, K6BMG cautions you to be sure to use a metal boom between the whips for good performance. The SuperDF performs best on vertically polarized FM signals. The receiver must be tuned exactly to the hider's frequency to prevent RDF errors due to receiver IF/discriminator response characteristics.

Quads on Six

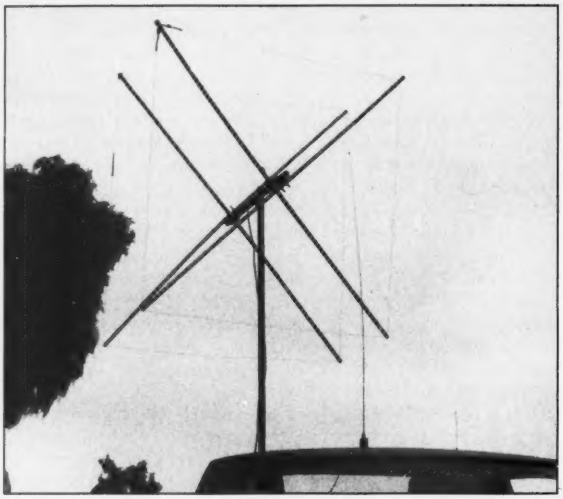

Photo A. You can get good 6 meter T-hunt performance and work some DX with a full-size quad, if you have a vehicle big enough.

Over the years, 6 meter hunters using quads have done better, on average, than loop and SuperDF hunters. John Wendt WA6BFH and Merrils Scheffer N6PON have won several 6 meter hunts using a full-size, 2-element quad in the back of a pickup truck. Merrils drives, and John sits in the truck bed to turn the quad (see Photo A). Rain makes hunting this way uncomfortable, though, so now they usually operate with the quad on a mast through the roof of a large van.

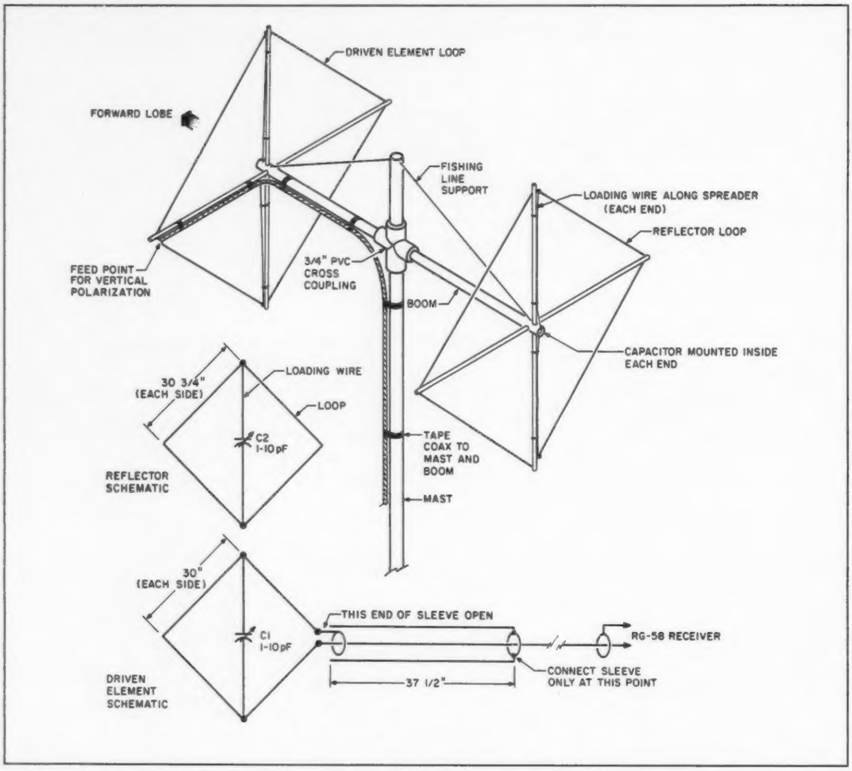
DRIVEN ELEMENT LOOP
FORWARD LOBE
FISHING LINE SUPPORT
LOADING WIRE ALONG SPREADER (EACH END)
REFLECTOR LOOP
FEED POINT FOR VERTICAL POLARIZATION
3/4" PVC CROSS COUPLING
BOOM
CAPACITOR MOUNTED INSIDE EACH END
30 3/4" (EACH SIDE)
LOADING WIRE
LOOP
C2 1-10pF
REFLECTOR SCHEMATIC
TAPE COAX TO MAST AND BOOM
MAST
30" (EACH SIDE)
THIS END OF SLEEVE OPEN
RG-58 RECEIVER
C1 1-10pF
DRIVEN ELEMENT SCHEMATIC
37 1/2"
CONNECT SLEEVE ONLY AT THIS POINT

Figure 1. Construction details for the 6 meter shrunken quad. See text for additional dimensions.

Shrink Your Quad

A full-size quad on 6m? The elements are over 4-½' on a side. That's too big and heavy for me! Fortunately, it's possible to "shrink" a quad significantly while maintaining good directivity. WA6OPS and I have had our share of wins with the antenna shown in Photo B. It is an adaptation of a shrunken quad design for 2-meter on-foot hunts (see Moell and Curlee, *Transmitter Hunting: Radio Direction Finding Simplified,* TAB Books #2701, pp. 173-176. Available from Uncle Wayne's Bookshelf). Capacitive loading techniques result in a quad with element dimensions only about half as large as the WA6BFH quad.

Build the Shrunken Quad

Figure 1 shows construction details of the smaller quad. Schedule 40 PVC pipe (thick wall) is suitable for the mast and boom. I used ⅜" wooden dowel rod for the spreaders and AWG 18 enamel-covered solid wire for the elements on my experimental model. However, fiberglass rod spreaders and copperweld wire would make a much more rugged quad. The capacitors are miniature piston trimmers. Don't use air variables because dirt and moisture on them will upset the critical tuning of the elements.

Cut a 22-¼" PVC pipe for the driven element half of the boom, and a 26-¼" pipe for the reflector side. Drill holes at right angles for the spreaders, being sure to space the holes so that the spreaders are just touching inside the boom. The point of contact of

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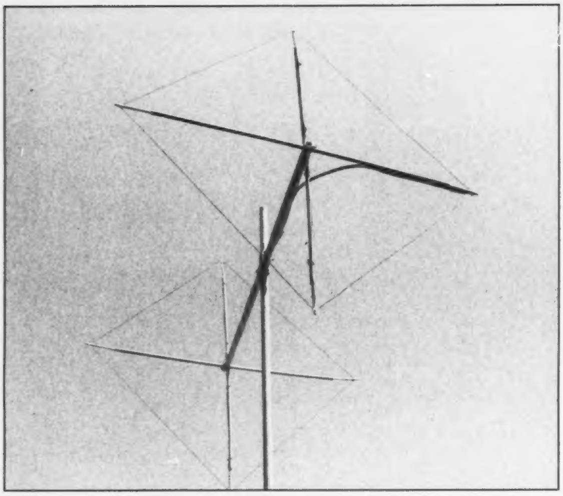

Photo B. This shrunken quad finds 6 meter transmitters just as well as a full-size quad, but it's only half as large.

spreaders is 1" from each end. This gives 48-¼" element spacing and proper balance when the two boom pieces are fitted into the ¾" PVC slip-type cross fitting.

Cut the spreaders 43" long for the driven element and 44" for the reflector. Drill small holes in the spreaders ¼" from each end for the element wire. When assembled, the driven element wire circumference is 120" and the reflector circumference is 123". Carefully distribute the wire between the spreaders so that the four quarter-wavelength spans of each element are equal in length.

When the loops are strung, add the loading wires and capacitors as shown. For ruggedness, drill small holes in the ends of the boom for the loading wires, and secure the trimmer capacitors inside the ends of the boom. Orient the capacitors so that they can be adjusted with a screwdriver from below. Complete the assembly by installing a 10" extension on top, with taut nylon fishing line supports to keep the boom from flopping up and down along the road.

Bolt the two boom pieces into the PVC cross fitting to allow disassembly for storage and transport. I secured everything else with hot melt glue to allow further experimentation and changes, but two-part epoxy would be more durable. Lace the loading wires securely to the spreaders and tape the RG-58 feedline to the mast and boom.

The balun minimizes distortion of the pattern by the feedline. The sleeve is a length of braid from an old piece of coax. Make a small cut in the coax jacket 37½" from the driven element end to expose the braid. Connect the added sleeve to the coax braid at this point and smooth it out over the jacket. Cut it off a quarter inch from the driven element end, making sure it does not contact the RG-58 feedline shield at that point. Put tape over the ends of the sleeve to keep it in place and prevent shorts.

Even at the reduced size, this antenna is too large to mount on a mast through a vehicle side window. You would be inviting a ticket for "excessive overhang." Instead, you will have to punch a hole for the mast through the roof, mount it in the bed of a pickup a la WA6BFH, or use your sun roof.

The antenna as shown is for vertical polarization. The diamond orientation prevents detuning caused by interaction with the vehicle's roof. For horizontal polarization, rotate each element 90 degrees. The feedline will then be at the bottom corner.

Give it a Tune Up

This antenna is not designed for transmitting. Do not tune it with a wattmeter or SWR indicator. Instead, connect it to a receiver with an S-meter and use a separate transmitter or signal generator as a signal source. Keep the source power low or use an RF attenuator in line with the receiver so that the S-meter stays in its linear range.

The transmitting antenna should be at least 50 feet away, using the same polarization as the shrunken quad. Mount the quad on your vehicle as it will be used for hunting. The vehicle and source should be in the clear, away from large objects, such as houses, trees, power lines, and other vehicles.

A loaded antenna such as this has a high Q. Its bandwidth for good directivity is quite narrow. Tune the antenna at the exact hunt frequency. If you change the hunt frequency more than 100 kHz, retune it. Wide spacing minimizes interaction between the elements, but can't eliminate it entirely.

To tune the antenna, first remove the reflector from the PVC cross and set it aside. Aim the antenna at the signal source and tune trimmer C1 for a peak on the S-meter. Hand capacitance will affect the adjustments, so overtune if necessary and always move your hand away to check results. Next, put the reflector back on the quad, point the antenna away from the source, and carefully tune C2 for a null on the S-meter. Turn the quad back toward the source and repeak C1, without removing the reflector this time. Repeat the sequence as necessary until no further improvement is seen.

A coax switch and a whip antenna should be included in your setup if you need to be able to transmit. A quarter wave whip on the side of the car does not affect performance of the shrunken quad. Don't forget to include an RF attenuator between the quad and receiver to knock down the signal as you close in and the S-meter pins.

Of course, this antenna does not have as much gain as a full-size 2-element quad, but it has more gain than a mobile whip and much better signal pickup than a small loop. On one recent hunt, all the loop users struggled to eke out enough signal to get an initial bearing, even with SSB receivers. All the while, both the K0OV shrunken quad and the WA6BFH full size quad were getting "armchair copy" and accurate bearings.

Six meter hunting with the shrunken quad is quite similar to hunting with a beam or quad on 2 meters. The main lobe is broader than the lobe on a full-size quad, but it's still sharp enough to get accurate bearings if you use a sensitive S-meter for strength indications. Occasionally you may drive into a location where the signal seems to be coming from all directions equally. Move a block or so away and try again. Happy hunting! ■

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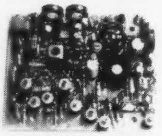

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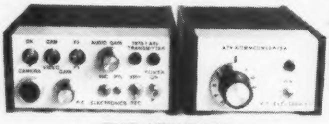

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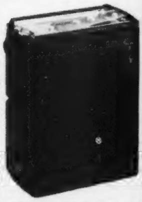

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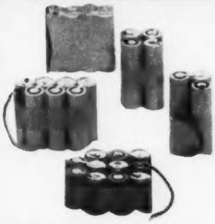

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Two Enlightening Packet Conferences

Last autumn I attended both the TCP/IP Interoperability Conference (INTEROP 89) and the annual ARRL Computer Networking Conference. What I have seen at these two event leads me to believe that 1990 is likely to be a watershed year for packet radio.

INTEROP is an academic conference and commercial trade show oriented towards "internetworking" different types of computer systems. INTEROP is significant to packet radio because the ideas and techniques displayed there will ultimately trickle down to amateur radio. The path works both ways—experimentation in amateur packet radio has had a significant effect on the Internet. (See the sidebar for a quick description of the Internet.)

At this year's INTEROP Phil Karn KA9Q, Brian Kantor WB6CYT, Mike Chepponis K3MC, and Kevin Rowett N6RCE attached the local area packet network in San Jose to the Internet using the KA9Q Net program and a couple of WA4DSY 56 Kilobaud modems. (See the October 1989 issue of *73* for a description of these modems.) This demonstrated to the Internet community the advances in amateur packet radio networking and allowed the local packet community to get a taste of what "real" computer networking is like. The results were so striking that they could very quickly spoil you.

The 8th Annual ARRL Computer Networking Conference

For amateur packet radio, this event is always important. New ideas and techniques are presented in the papers and most of the people who actively work on the development of packet radio technology are present to exchange ideas.

This year the conference was held on the grounds of the US Air Force Academy in Colorado Springs. It was very well attended (143 pre-registered attendees) with people coming from 23 states and seven other countries (Australia, Canada, Costa Rica, England, Germany, Netherlands, and Sweden). Authors wrote and presented 29 papers covering everything from applications to modems. The Rocky Mountain Packet Radio Association (RMPRA) did a first-rate job in organizing the conference.

New Commercial Products

The major packet manufacturers, (e.g. AEA, DRSI, Kantronics, and Pac-Comm) showed significant new products that will raise the performance of packet radio by at least an order of magnitude. Bdale Garbee N3EUA had the new PK-186 packet switch that AEA will be releasing (probably by the time you read this). The PK-186 is a high performance, four-port packet switch. Each port of the PK-186 is capable of over one megabit per second (1 Mbps) throughput. Just the thing for a high-speed, mountaintop packet switch!

DRSI was on hand showing their Awesome I/O (AIO) board designed by Mike Chepponis K3MC. The AIO board is a four- to ten-port packet radio board designed to fit into an IBM-PC or clone. The AIO board is in many ways similar to the PK-186. The first four ports are designed for high speed (>1 Mbps) operation. The optional six additional ports are designed for low speed (300, 1200, 9600 bps) operation. For people who do not have a PC, the AIO board can operate stand-alone. Just feed the board a diet of clean and regulated +5 VDC and it is happy to do your bidding sans PC. (It also needs a source of ±12 VDC if you want to use an RS-232 connection.)

Kantronics displayed two truly revolutionary devices: a radio designed for packet operation and a high-speed TNC. The radio, the DVR2-2, is a two channel crystal-controlled rig that operates on 2m and produces 2W of RF output. It was designed from the ground up for packet radio. In addition to its very high speed T/R switching, the DVR2-2 has direct access to the discriminator and the modulator for optimum signal quality. It can be used without modification with the 9600 bps modems that are now available. The DVR2-2 is housed in the same package as the KAM. The suggested retail price is $199.95, but I am sure that it will be discounted by the mail order dealers.

The new Kantronics TNC is called the DE-56 "Data Engine." This is a three port (two radio/modem ports and one computer/terminal port), high speed TNC. The radio ports are guaranteed to operate at 56 Kbps and probably faster (my guess is that they should work at speeds in excess of 250 Kbps).

At the heart of the DE-56 is a NEC V-40 microprocessor. This means that the DE-56 is essentially an IBM-PC in a KAM-sized box (no, it is not a PC but it can potentially run the much more powerful packet software that, up to now, only ran on a PC or similar computer). With its ability to accept and use up to 512 Kb of RAM/ROM, the DE-56 is truly the next-generation TNC.

The ARPANET/Internet

The Internet is the world's first and largest packet switching computer network, consisting of over 20,000 computer systems. Activated on September 1, 1969 as the ARPANET, this collection of four connected computers became the world's first packet switching computer network. Much of what is known about packet switching has come from research done on and with the ARPANET (packet radio had its beginnings as part of the ARPANET many years before anyone even thought of AX.25 or a TNC).

In the early 1980's the ARPANET was split into two pieces known as the ARPANET and MILNET with the ARPANET continuing to function as the experimental and academic network while the MILNET became the Department of Defense's non-classified operational computer network. Also around that time TCP/IP was adopted as the networking protocol standard. This rapidly growing collection of host computers and networks was then renamed as the "Internet."

Today the Internet consists of more than 20,000 host computer systems connected by coax cable, fiber optic, telephone, and radio links. The people who maintain and operate the Internet have set aside over 16,000,000 host addresses so that the amateur packet radio network can be interfaced to and become part of the Internet. Our network has the name AMPR (AMateur Packet Radio).

Pac-Comm demonstrated a new, very tiny TNC-2 work-alike. Pac-Comm's new TNC is about the same size and price as the Heathkit tiny TNC but it offers some significant advantages over the Heath product. First, the Pac-Comm TNC comes stock with a 550 mAh battery pack that will let it operate for many more hours than the Heathkit TNC using its optional battery. Second, the Pac-Comm TNC will support the KISS protocol necessary to use the TNC with the more advanced packet programs. If you are into portable packet this will be a welcome product.

New Amateur-Built Radios

Radios seemed to dominate the convention. It seems that packeteers have gotten the message—that the radio is just as important as the TNC. Bdale Garbee N3EUA was there with the 10 GHz transceivers that he and Glen Elmore N6GN designed and built. Fresh experimentation has pushed the speed of these microwave packet transceivers up to 10 Mbps. That's right: ten MILLION bits per second, or about 10,000 times faster than our current TNCs. These transceivers are perfect for a high speed packet backbone.

Kevin Rowett N6RCE also talked about the high speed digital radios that he and Glen Elmore N6GN have designed and tested. These are complete radios that operate at either 900 or 1,200 MHz. They will transmit data at speeds up to 500 Kbps. Unlike the 10 Mbps/10 GHz point-to-point transceivers, the 900 MHz transceivers are designed to operate the same way we now operate: using omnidirectional antennas with many people sharing a channel. The appearance of the PK-186, the DE-56, and the Awesome I/O make these radios very practical. Kevin and Glen are working out how to get these radios available in kit form so that just about anyone can build one.

What Next?

The appearance of all this wonderful, high speed hardware makes it possible for us to implement high speed networks. The big question now is what do we want to do with them? So far there has been little or no change in amateur packet radio operation since its inception in the early 1980s. We still use TNCs at 1200 baud with crummy Bell 202 modems connected to narrowband FM radios. In the digital world this is equivalent to using spark to send Morse code. Given this level of technology, the message switching BBS network that ensued was about the best that we could have hoped for.

Now that we have access to faster services 9,600, 56,000, and 500,000 bps technology will become commonplace. Backbone links will actually run at 10,000,000 bps. The PK-186, the DE-56, and the Awesome I/O make it possible to switch packets reliably at these high data rates. So what do we do now?

Here are some of the applications that I expect a high speed network to provide: digital voice, digital voice repeater trunking, digital freeze-frame video (digital SSTV), computer disk sharing, mobile packet, on-line callbooks, digital FAX, and more. Those are my ideas and desires.

But what services do YOU want a high speed network to provide? Please send your ideas to me care of *73*. Send me ideas for uses but don't spend a lot of time on how it should be done. Just imagine what you could do with a reliable, high speed channel between you and the rest of the ham community; one that is unencumbered by propagation, QRN, and/or QRM. I will print the ideas here (with credit to the originator, of course). I am sure that the hams who build the hardware and write the software will be interested in new ideas, and will see your wishes as a challenge. ■

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UPDATES

October 1989 "Tech Tips"

First, let's get Bill Hickox's callsign correct: He is K5BDZ (NOT KB5DZ). Second, he writes that the ICOM power supply is not "internally switched."

Next, he cautions that the method will not necessarily "put you where you left off" when it comes back on. That depends on the model, memory in use, battery backup, etc. But the rig will turn on, and you can proceed with normal operation.

December 1989 "QRP"

Mike Bryce WB8VGE states that there are some errors in the schematic for the August 1989 project, a pulsed battery charger. First, the blocking diode wasn't labeled. It can be a 1N4001 or any diode rated at 1 amp or more. Of course, if you use the LM350 with its 5 amp rating, you'll also need a larger diode—and you'll need to increase the current from the transformer and diode bridge setup. Next, the unmarked resistor on the collector of the transistor is 220Ω. The transistor should be a 2N2222 or equal. Last, the 2.2kΩ resistor is shown as a trimmer, which it is not. Use a 2.2kΩ resistor, and ignore the wiper connection. ■

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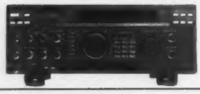

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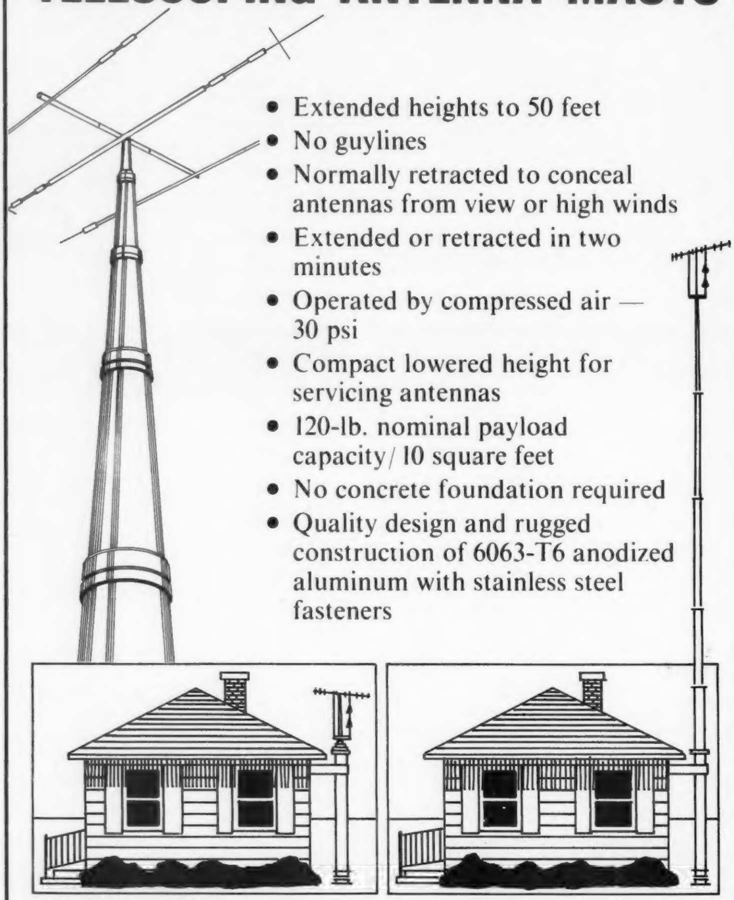

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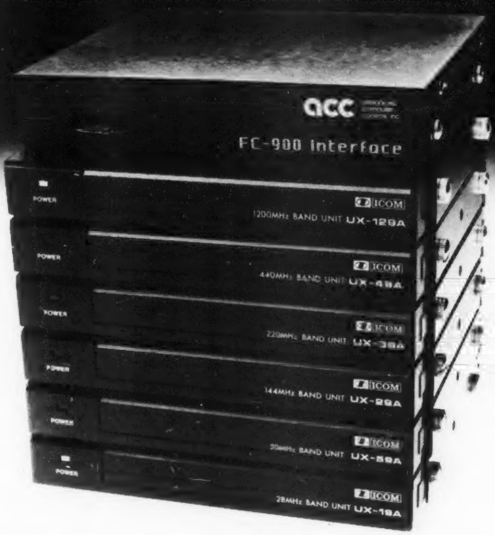

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Frequency Counters and Accuracy

In many cases these days frequency measurement isn't critical. Synthesized radios for HF/VHF/UHF operation are more than accurate enough for even narrowband work such as SSB and CW. Even if you had a non-synthesized rig for the above sub-spectra for which you needed to check the frequency, counters abound that give you more than enough accuracy. A common frequency counter basic stability is 1 PPM (part per million)—which is 150 Hz at 2 meters and 450 Hz at ¾ meters. There are frequency counters available, such as the Digimax D-1200, which has accuracy to 0.1 PPM, a factor of 10 better than the standard models, giving you 15 Hz at 2 meters.

This may be accurate enough for VHF and below, but not so for microwave SSB operation. At 10 GHz the above accuracy can range as much as 10 kHz—unacceptable when you consider that SSB signals are typically only 3 kHz wide. Even at 0.1 PPM, the error is still a hefty 1 kHz at 10 GHz.

Getting More On the Mark

First, check these counters to verify your accuracy by using WWV transmissions on 5, 10, 15 or 20 MHz. The best that you can set your time base crystal on frequency with these frequencies is 1 part in 10 to the 7th (0.1 PPM) or slightly better. Just what the doctor ordered to bring the counter back to its original specifications! See Table 1 for specs on the frequency counters available.

You can also increase your counter's accuracy by using an external frequency standard, or a different counter than those listed in Table 1. The Hewlett Packard HP-5245 counter does not have the portability of the counters listed in Table 1, but it is a bench counter of high quality. This basic 50 MHz counter accepts plug-in units, extending its useful range to 18 GHz (see Table 2). The HP counter uses a very high quality 10 MHz internal frequency standard accurate to a few parts in 10 to the 10th for short term stability, and it will hold 1 part in 10 to the 9th easily. That's equal to 0.1 Hz at 100 MHz, or a scant 10 Hz at 10 GHz. Now we're getting somewhere!

You can use only one plug-in unit at a time in the HP counter. All plug-ins derive their basic accuracy from the counter's proportional oven-controlled 10 MHz crystal oscillator. Frequency is multiplied in each plug-in for use in down-converting to the basic counter.

Calibrating Your Counter

Calibration of this timebase oscillator differs. When setting with WWV we can only be sure of part in 10 to the 7th, or slightly better, due to phase shifts in the atmosphere from transmitter to receiver. Besides, the basic counter, if operating properly (in calibration), has better accuracy than WWV "as received." Obviously, we need a better method to calibrate it.

Enter WWVB operating at 60 kHz. At this low frequency, the low phase shift allows the transference of the standard at the transmitter to remote receivers with tremendous accuracy. You can verify a part in 10 to the 9th in short order, and 1 in 10^{10} takes just over eight hours. That's 1 Hz accuracy at 10 GHz—now we're really close to the mark!

At these frequencies, the phase difference between the local standard and the received 60 kHz reference signal is compared, and any accumulated errors (phase difference) in the form of time error in microseconds are tracked. Over a period of time, this will show if the local oscillator is lagging, leading, or right on, compared to the phase of the received 60 kHz WWVB signal. Quite an accurate method. Matter of fact, this is how calibration labs maintain calibration certifiable to the national Bureau of Standards.

> ***"I have seen used counters selling for as little as $50 . . ."***

Moral of the Story

Don't scoff at the older counters at flea markets—you just might want to pick one up. A direct cousin to the HP counter is the Systron Downer counter. Their older models look a lot like the Hewlett Packard 5245. Caution: Do not assume the counter is accurate when its internal counter is set to check its own reference. It will lie, lie, lie. Remember that the master oscillator sets the timebase. If the oscillator is out of calibration, everything else will be, too. A good quick check is to use a 150 MHz or 450 MHz HT to make a basic operational check.

Affordable

I have seen used counters selling for as little as $50 and as much as $250. Plug-ins in working condition go for $25 for the 500 MHz unit, $75 for the 3 GHz, and about $200 to $300 each for the 12.4 GHz and the 18 GHz units.

The receivers used to calibrate the high quality standard found in the HP-5245 counters are made by several companies, including Hewlett Packard and Tracor. I use the Tracor 599 60 kHz receiver to calibrate my standard oscillators locally. Check out your local swap meet—one of these just might show up.

Table 1.
Available Frequency Counters

Digimax	D500	50 Hz to 512 MHz	1PPM	
	D510	50 Hz to 1 GHz	1PPM	
	D612	50 Hz to 1.2 GHz	0.1PPM	Proportional oven
	D1200	10 Hz to 1.2 GHz	0.1PPM	Proportional oven
Ramsey	CT-70	20 Hz to 550 MHz	1PPM	
	CT-90	10 Hz to 600 MHz	1PPM	
	CT-125	10 Hz to 1.2 GHz	1PPM	
	CT-90	10 Hz to 600 MHz	0.1PPM	With option OV-1
Optoelectronics		10 Hz to 2.2 GHz	1PPM	

Table 2.
Plug-In Modules for HP-5245 Counters

HP-5253	50 MHz to 500 MHz
HP-5254	300 to 3000 MHz
HP-5255	3 GHz to 12.4 GHz
HP-5256	8 GHz to 18 GHz

5760 MHz World Record

On July 23, 1989 at 0157 UTC, N6CA/6 and N6SNA/6 (CM94XM) worked XE2GXQ/N6XQ (DL37CK) on 5760.1 MHz SSB, over a distance of 613.4 miles from west of Santa Barbara, California, to south of Guerrero Negro, Baja California, Mexico. Signals were 20 to 30 dB out of the noise with QSB, but Q5 99% of the time. XE2GXQ/N6XQ was also worked on 3456.1 MHz SSB at 0046Z with similar signals. Both QSOs lasted more than 10 minutes. This 3456 QSO is a North American ducting record. Margaret N6SNA also completed a contact on 3456.

Equipment at both ends was identical and primarily surplus and home-brew by N6CA. W7CNK/WA5TNY designed the 3456 and 5760 antenna feeds. Antennas at both ends were four-foot dishes. Power at 5760 MHz was 4 watts and 1.5 dB noise figure receivers. Power on 3456 MHz was 1.5 watts and a 2.5 dB noise figure receiver. Elevation for N6XQ was 150 feet and about 1600 feet for N6CA.

N6XQ's trip wasn't easy. Fourteen hours of rough roads to the first location, then a six hour drive just to move 65 miles north to his final location. Radio conditions were below normal. Liaison on 2 meters was marginal, so part of the attempt was assisted by 220 MHz FM from N6CA to XE2UZL/W6UZL (280 miles), 28.885 MHz from XE2UZL to KH6HME on Mauna Loa Hawaii, and then to XE2GXQ. Eventually a 2 meter liaison was established at 613 miles. 1296 SSB was 1 to 3 dB out of the noise with 20 dB antennas and 10 watts and 1 dB noise figure receivers.

These are the first amateur contacts between Mexico and the US on 3456 and 5760 MHz.

As always, I will be glad to answer all your questions. Please submit an SASE with your questions for a quick response. 73 until next month . . .

de Chuck WB6IGP

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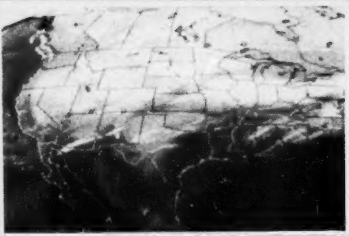

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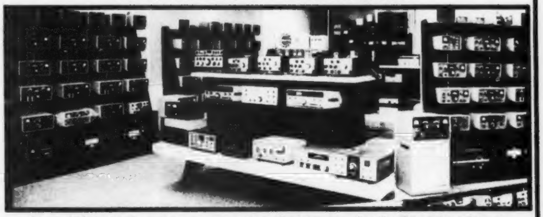

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V-425	40MHz	D.T., 1mV sens, DC Offset, CRT Readout, Cursor Meas	$1,070	$849	$221
V-660	60MHz	D.T., 2mV sens, Delayed Sweep, CRT Readout	$1,295	$1,145	$150
V-1065	100MHz	D.T., 2mV sens, Delayed Sweep, CRT Readout, Cursor Meas	$1,895	$1,670	$225
V-1100A	100MHz	Q.T., 1mV sens, Delayed Sweep, CRT Readout, DVM, Counter	$2,450	$2,095	$355
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Thirteen Years of RTTY Loop

From this column's beginning in the summer of 1977, some of the items most requested over the years for "RTTY Loop" have been the "one-night project" and the "simple but useful test equipment." This month I try to address both of these needs.

Finding a signal to tune up with to help set your RTTY station, or just to fool around with, is sometimes hard. While the ham bands are normally replete with signals, that strong continuous one you need is just never around when you need it. What the country needs is a good, five-dollar RTTY signal generator.

While I wouldn't send the signal generated by this month's circuit out over the air, the signal is certainly sufficient to tune up a receiver or demodulator. As for cost, it would be hard to do it for less!

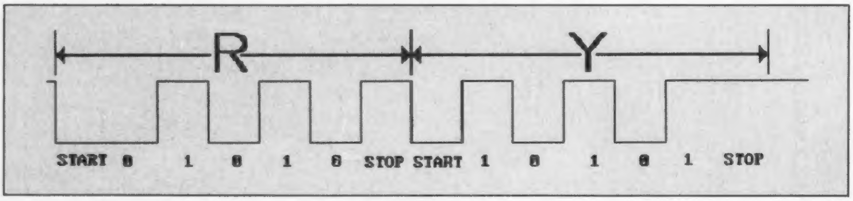


Figure 1. Basic TTY signal.

RTTY Fundamentals

Since many of you have indicated a need for more basic information regarding the fundamentals of RTTY, a little theory is in order before we look at the circuit. You may recall from some of our earlier columns that a RTTY signal is really nothing more than a series of binary digits, changes in state if you will, with a maximum rate determined by the speed of data transmission.

"Changes in state" refers to any change in the signal to represent two distinct signals. On a binary circuit, these are nominally referred to as "1" and "0," "on" and "off," or "high" and "low." The terms used really don't matter. What's important is that the two signal levels are representable. With a wired circuit, these two levels are produced by the presence or absence of a current, a change in the polarity of a current, or a change in the level of a current.

In a radio circuit, these same changes in state are produced by changing, most commonly, the frequency of the radio signal. Such a change of the base radio frequency is called FSK—Frequency Shift Keying, while a change in the modulating audio tone frequency is called AFSK—Audio Frequency Shift Keying.

Rate of Transmission

When we encode the pulses that make up a TTY signal via FSK or AFSK, and send them serially down the line, we define a pulse rate based on the maximum speed. That is, the shorter the pulses, the faster the potential rate. While the actual frequency of the signal may vary, depending on the characters being sent, an idealized frequency rate, based upon the shortest pulse, is often used to express the data transmission rate.

Figure 1 is an attempt to diagram just such a case. Here, a signal is alternating between an "on" state and an "off" state on a pulse by pulse basis. We thus have the highest possible frequency being sent over the circuit. For the sake of argument, if this is a "standard" 60 wpm TTY system, each pulse is 22 milliseconds (0.022 seconds) long.

You can calculate the frequency by finding the reciprocal of 0.022 sec/pulse, which would be 45.45 pulses/sec. Pulses/second is essentially the same as cycles per second, which we call Hertz. That makes the frequency 45.45 Hz, which, just to throw some more units at you, is also referred to as 45.45 bauds. Keep that number in mind, we will need it later.

Before we leave Figure 1, notice one more thing. The regular sequence of "on" and "off" pulses diagrammed for this exercise form two letters in the Murray, or Baudot, code: RY. Ah, so that's why you use "RY" for testing, I hear some of you say. But just the same, if you had a square wave generator, and set it for a frequency of 45 Hz, you might just find that you had created RY-in-a-box!

Now—The Pulse Generator

Wonder of wonders, can anybody guess what Figure 2 is? Here we used that ubiquitous, cheap 555 timer chip to create just the pulse generator we have been talking about.

Easily assembled on a perfboard, this one-chip project should take about an hour to put together once you have the parts. You can get all of the parts at your local Radio Shack or by mail (see parts list). Feeding it from a battery, it should last almost forever.

The output of the chip, at pin 3, is at TTL level. The simplest way to use it is to send this signal to the AFSK generator (see the August *RTTY Loop* for a simple, one-chip AFSK generator), and obtain a continuous "RYRY" signal you can use for local testing.

Simple RY Generator Parts List

Part	Radio Shack #	Cost
Integrated Circuit:		
555 Timer Chip	276-1723	$1.19
Resistors: (use potentiometers; adjust to exact resistance):		
500Ω pot	271-226	.69
5000Ω pot	271-217	.69
Capacitor:		
10 µF Tantalum	272-1436	.79
Perfboard:		
2.75 x 6 IC punched	276-1395	1.79
IC socket:		
8-pin DIP	276-1995 2-pack	.59

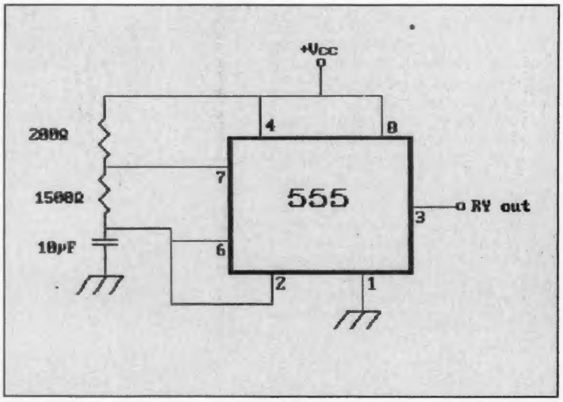
Now, one caveat: This is a 45 Hz square wave. Perfect RTTY would have a stop pulse of 31 ms rather than 22 ms (look at Figure 1). That means this signal is not perfect, and will tend to drift after ten to twenty characters or so, depending upon the exact frequency rate. That is why I suggested you *never* put it over the air! But for local testing and alignment, or to provide a frequency shifted signal to set a demodulator, it can't be beat!

Above All, Have Fun with It

If you have any requests for simple, one-evening devices, or if you have solved any problems like this yourself, please drop me a note at the above address or via the electronic services detailed below, and let me hear about it.

On a related topic, many of you have moved quite beyond making RTTY pictures with characters as we did years ago, into the realm of digitized video that can be transmitted in file format over RTTY and packet, or BBS circuits. While there are quite a few high-end, expensive packages, such as the ones making T-shirts at the mall, several affordable digitizers are now available. Next month we'll take a look at two of them, head-to-head, and see what they can do. I am amazed at the quality these little boards produce.

For now, don't forget to let me hear from you by mail, or via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). I read every comment! 73



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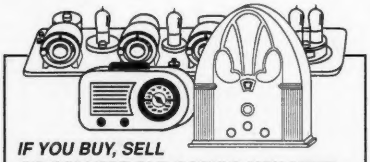

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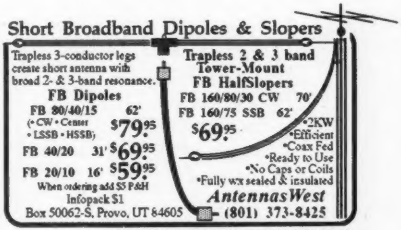

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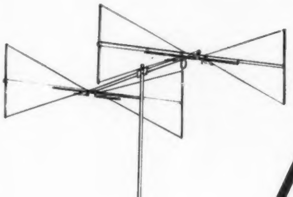

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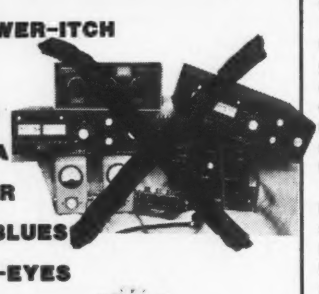

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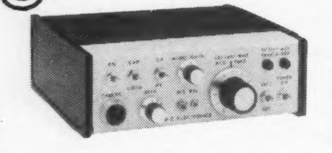
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Continued from page 4

with you, but I enjoy your editorials."

Hmmm, if they don't agree with me on something, is it their ignorance or mine? Very few readers have enough confidence to actually write to me when they disagree.

As one of the founders of American Mensa, I've talked with hundreds of people with outstanding brains. I can assure you that a distressing number of them are poorly educated and that they don't let this interfere with their ability to hold strong opinions, no matter how wrong.

There's a tendency to think of education as ending when one gets out of school. That may be true for the functionally illiterate. How many books have you read recently—other than novels? My library has over 6,000 books I've read—plus I read about 1,500 magazines a year. The reason I'm able to write on a wide variety of subjects with confidence is because I do my homework.

It doesn't take a high IQ to be able to read. All it takes is the perseverance. Does that sound familiar? Tsk, you didn't read Ray Croc's book on success. Croc? The McDonald's chap—tsk again. Yes, you have to work at it to be educated. You also have to work at it if you want to be successful. The prizes for both are well worth the effort.

My trips in recent weeks have given me the time to catch up reading a few books. If you're interested in my diving trip, call our BBS and get a dump of "Diving, The Wimp Sport." You'll enjoy it.

Hey, if you're into scuba diving (and good at it), maybe we can get to some Caribbean islands for a joint ham and scuba DXpedition. If you're into skiing I can't understand why you haven't been joining our ham ski group in Aspen for the last fourteen years. We'll be there January 9–15th, HTs ablaze. We have both intermediate and expert skier groups.

Having been getting senior citizen discounts for some five years now, I obviously have an added impetus to learn more about the "next world." But this also ties in with amateur radio. If you're interested in a very complete book on cosmology and the latest thinking about there being alien civilizations, check out *The Anthropic Cosmological Principle* by Tipler. It's an exhaustively referenced scientific work.

The main reason scientists give for being sure there aren't any other intelligent civilizations is that we haven't heard any radio signals from them. Hmmm. Isn't it a tad arrogant to assume that we will never discover a better communications medium than radio? Heck, even a laser beam would have a much wider bandwidth and be better focused than radio signals. There could be laser communications all over our galaxy and we'd never know it. And if a faster medium is discovered, radio would be about as useful as smoke signals.

Ants and termites work both as individuals and as groups and thus have some means of group communications. Even people behave entirely differently in a group (mob). How's this work? How is this communicated? We do have some hints as to other communications systems, we just have had a cultural bias against investigating these things.

Another book, *Voices of Eternity* by Estep, explained how she set up rudimentary communications with the spirit world using a VHF radio and a tape recorder. A chap named Raudive wrote a book on this about twenty years ago, but his results weren't nearly as convincing. It seems that our "silent keys" may not be as silent as we thought. I'm going to set up a test system which will be thousands of times more sensitive than the one Estep is using and see if I can get in touch with Mort Kahn W4KR and see what he thinks now about Incentive Licensing, which he put through when he was running the League 25 years ago.

By the way, I realize that communications with the dead—particularly with the dead of other solar systems—is ridiculous. That's nut house fantasy, right? Alas, I have it from two personal sources that not only is this possible, but our beloved government has already invested hundreds of millions in the project. With any encouragement I'll start a magazine to help this new communications field develop.

Now, is that Wayne being controversial again? Are you tending to disagree with me? Not if you are educated in this, you aren't. If this is controversial for you perhaps it's because you need to read more.

Is Africa Hopeless?

A *QST* editorial by Dick Baldwin stirred up controversy (tsk) by suggesting the collection of old ham gear to be sent to Africa to help develop more hams there. Why controversy? Well, the cynical view is that Baldwin is just trying to get more action for *QST*'s Honor Roll addicts—which, unfortunately, is about all that would probably happen.

Unless one has actually visited Africa it is difficult to understand what is and has been going on there—and what this means for the future. Baldwin mentions that outside of South Africa there are less than a thousand hams in Africa, and those are mostly Europeans. I wonder if there are even a hundred Black hams in all of Africa. Heck, look how few we have here in America!

The Black countries I've visited in Africa over a period of years are all running down—falling apart. The lack of education and communications has made it simple for dictators to take over and plunder what little there is to take—including as much from American banks as they can get to salt away in Swiss accounts or spend on showy but useless projects. Now our banks are at a loss—the money they've lent has been wasted, so the countries have no way to pay the interest, much less pay back the loans. There's not even a way to get the money they need to develop their economies so they can start paying back the old loans—and we have no assurance that further money wouldn't go the same route as the last hundred billion or so. Just what this massive bank stupidity is going to do to the world financial system is still unknown, but many economists are terrified that the facade of possible repayment may crack, setting off a world panic.

We know American investors are getting very edgy about the continued build up of our stock market. We're hearing warnings that the Tokyo stock market is incredibly over-expanded and ripe for a crash. Even a mini-panic could send it into a free fall, building up momentum on margin calls which can't be met—the same as happened here in 1929–30. Would that pull our market down too? It easily could.

> ***"As you can see, I tend, for a change to agree with Baldwin's critics."***

With so little education and communications in most Black African countries, there's no way for them to develop business. The local market is too small to help businesses get started. There are few educated people to start and run businesses. The purpose of the bank loans was to break this circle of poverty, but without strong controls (which the dictators refused to allow), the money just evaporated—billions of our American hard earned dollars. Let's not forget just who had to earn all that money our banks have thrown away.

What can be done to help Africa? I don't think there's anything that hams can do to change things. Without education, there's no way to get better African leaders. The leaders know this, so they're not encouraging education since that would eventually lead to their losing power.

If we want to blame anyone for the Catch-22 in Africa we can dump on the colonial powers who all had policies of keeping the natives uneducated so they could exploit their resources without organized opposition. It worked fine until the countries were suddenly cut loose in the '60s.

My approach would be to find one or two of the 59 countries where there seems some hope of developing education. Not all are being run by despots—just most. I'd visit them and talk with the presidents, explaining the importance of electronics and communications to the future of their country. Then I'd explain that the only practical way to cope with this is to develop native engineers and technicians. The best way to do this is to start teaching the fundamentals of electronics and communications in their elementary schools.

By supporting these fundamental courses with radio, electronic experimenting and computer clubs, children would be encouraged to take a personal interest and head toward technical careers. The cost is relatively low—teaching materials for classes, club ham stations and computers. If our banks had sent this type of help to Africa instead of billions in cash, we'd be seeing major changes there. And the cost would have been peanuts by comparison.

Would this work? I know it would, because that's exactly what I did in Jordan and it sure worked there. There are more Jordanian hams today in that tiny country than Black hams in all of Africa, including South Africa. This is the reason that Jordan is by far the most technologically advanced of all the Arab countries.

As you can see, I tend, for a change, to agree with Baldwin's critics. Sending ham gear to Africa right now, I feel, would be a waste of time and money. It would just go the route of the billions of our dollars already shipped to Africa—wasted.

If we can get one or two countries started teaching their kids the fundamentals of electronics, communications and computers, then we'll have a need for collecting old ham gear and computers and shipping them to Africa for use by clubs. Until then, let's cool our normal American generosity—let's leave that to our banks—the same banks which don't want to talk with us when we need money can't seem to find big enough shovels for dictators. . . and even our very good friends in communist countries. Incredible, isn't it?

Museum Progress

As a fifty-year member of The League and legendary League supporter, I'm excited over the plans for the ARRL Amateur Radio Memorial Museum and Visitor Center. This recently funded multi-million project seems to be progressing nicely. You may be interested in some of the rumors I've heard.

The architects have been instructed to work on a plan for making the new building so it would look exactly like the fabled Hallicrafters Skyrider Diversity receiver, in honor of the Hallicrafters Company, which so heavily "endowed" the League during its heyday. A new art deco building like this could attract national attention.

Some of the directors favored making it look like the National HRO receiver, but when it was found that the only surviving museum-quality prototype HRO would have to be purchased for a pretty penny from the fabled *73 Magazine* Amateur Radio Memorial Museum, the directors were dissuaded.

Even with the delays in the design of the building, the exhibit acquisition program is said to be already well ahead of plan. Despite a surprisingly

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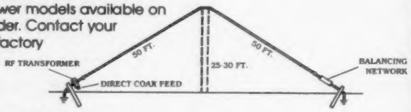

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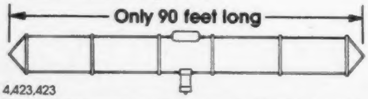

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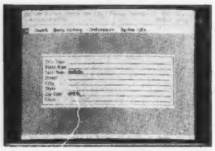

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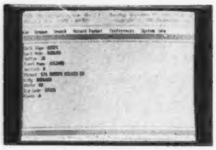

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vigorous bidding war, the League is reported to have managed to get a set of tapes of the activity on 3999 kHz for a 24-hour period in 1963—surely a historic treasure, and worth far more than the measily $50,000 asked.

Another great exhibit is expected to be a complete set of Don Miller's 1960s fake DXpedition logs. There is also said to be a large exhibit of faked QSL cards which have been submitted for DXCC credit. Yes, Frank, yours are all there.

Still in negotiation is a set of tapes containing a one-month certified record of all activity on the 220 MHz amateur band in the 30 largest American cities for February 1986, rumored to be an exhibit prepared by UPS to demonstrate the almost total lack of actual amateur radio activity on the band. Since most of the tapes are blank, there is some question as to the value of the exhibit to anyone other than UPS.

A ham attorney in Southern California has offered a set of 10,000 hours on audio cassettes of Southern California repeater jamming and profanity. The Board hasn't decided yet what to do about this prospective exhibit. With expletives deleted it is estimated this could be edited down to about two hours of drivel.

Editing is still being done on an exhibit of video interviews with the only two persons ever tried, convicted and put in prison for using obscene language on CB. Both are Extra Class hams. They both had interesting, though unprintable, views on the new ARRL museum project. Prison seems like a particularly odd place to send people to try and cure them of using bad language.

The Southern California DX Association is said to have offered an audio tape of the 100 largest DX pileups in history to the Museum as an exciting acquisition.

If you have any ideas for amateur radio memorabilia which might help the directors, you might send them to the ARRL Amateur Radio Memorial Museum at Newington CT 06111—copy to me.

It's been suggested that since I'm not a League official it's incumbent on me to start an unofficial building fund campaign to help pay for the substantial cost overruns which the Museum project now seems certain to incur. It's something which should (must) be done, but it's only fair to point out that since my constructive suggestions to the League in the past have been blown all out of proportion, I insist that others undertake this critical responsibility.

Public Education

This is almost an oxymoron today. We in amateur radio in particular have been the victims of the American public educational system. The time was when the average high school student had more than enough science education to pass the Novice theory test. Today, with under 10% of our kids even being exposed to the fundamentals of physics, much less electricity and electronics, is it any wonder our source of life for amateur radio has dried up? The last figures I saw showed our newcomers had dropped 35% in the last three years. How dry can it get?

The American educational system has failed our country massively. It's been taking longer to teach less, changing amazingly just in my lifetime—and most of yours. The lack of basic science education has made it possible for America to lose its consumer electronic industries, one after the other.

But the situation is far more serious than our loss of technology. Today we're awash in crime and drugs—we're having to live with ethical situations we don't understand, with our children living together, but not married—with a high percentage of fatherless families—with divorce rates which are incredible—with lawyers running amok and politicians stealing us blind at every turn.

All this comes down to a lousy educational system. Kids who grow up to be criminals must have gotten educated to that somewhere, right? The easy scapegoat is the family—what's gone wrong with the family? That comes right back to education again. Families today are the products of our educational system.

Our system provides relatively cheap and government enforced babysitting for all kids over five. This made the two-parent working family possible. The increased earnings of two wage earners first gave them better houses, cars and all the other things our educational system has established as life goals. Naturally the prices for these things increased, making it necessary for there to be two wage earners just in order to maintain the status quo. Tough.

We hear at every turn that the drug situation is one of education. So what are we doing about it? Not one approach I've heard about so far has claimed to work. When are we going to face up to the fact that our public school system is not teaching kids the truth about drugs? We're also not teaching much about ethics, getting along with people, cooperation and a depressingly long list. Our public educational system is a $100 billion disaster—a dinosaur.

The bright side of this is that there have been a growing number of books recently exposing the rottenness of our system. Even the educational magazines are getting more militant about this—and I subscribe to over a dozen of them. If you're interested you might look to your local library for *Kappan,* the Phi Beta Kappa magazine, to *The Education Digest* and to *T.H.E., Technical Horizons in Education.*

Okay, so the time is getting ripe for a change. What can we do about it? By now we know better than to fight City Hall. We can't win a direct confrontation with a $100 billion a year government monster. No, but we can come in from left field before the bloated, malevolent monster wakes up to what is going on.

The weakness of any monster is its resistance to change. Our military took a terrible drubbing in Vietnam by resisting the changes needed to meet the local circumstances. You can see many examples of how new, innovative companies have sprung up and toppled huge industries. The Swiss used to have the watch industry all to themselves. Along came the digital watch and put their whole country out of the business.

By the way, it was America that started the digital watch business. I've still got a box of the early American digital watches. Then Japan came along and killed us with lower cost and far more innovative watches. They invented circles around us and put our watch companies out of business.

> ***"It's difficult to get people to work for the long run. This takes education."***

Okay, our public educational system is a horrible failure. Kids aren't learning to read and write, they're left wide open for the seductiveness of drugs, early sex, having illegitimate children, getting involved with crime, accepting divorce as a substitute for a more intelligent marriage system and so on. I don't have to tell you all that's gone wrong. You see our kids hanging around shopping malls, smoking cigarettes, buying drugs. You see them cruising in pickups and on motorcycles.

We wonder if the plethora of crime programs on TV are an exaggeration. Then we read the statistics on drug smuggling and drug murders and we know what we're seeing is more reality than the lurid creations of fiction writers.

We see our kids buying alcohol and getting killed by the thousands in car crashes. Those of us in the country see empty six packs by the roadside, thrown out by teen-agers sitting in their cars drinking. We see the tire marks where they've challenged each other. We read about their accidents and attend the funeral services. Who among us hasn't experienced the loss of a friend through alcohol? Very few.

I say this is a failure of education—a failure of our public schools to teach our children how to live in the world of today. We have the transportation and communications to make anything available we want. If we want drugs from Burma, they'll get here and no escalation of our war on drugs is going to stop them.

Yes, we can cancel the laws against drugs and cut their growth by eliminating the profits, but we're still going to have to do what we haven't done—teach kids the facts about drugs—why they are so attractive—and why they are so destructive.

It's difficult to get people to work for the long run. This takes education. It's this inability to work for the long run which has made it possible for us to live with a public educational system which has grown to a $100 billion a year government operation. No well-educated kid would smoke cigarettes or chew tobacco. No educated kid would be stupid enough to get hooked on heroin or cocaine. Would kids even drink beer if they really understood all the pros and cons involved?

If our educational system leveled with kids it would explain that they're being manipulated by the alcohol industry to think that it's grown-up to drink. Is it really? Or is it even more grown-up to be able not to drink, even when pushed by peers? I used to feel this pressure, but once I figured the whole thing out I had no more problem with it. I don't drink and you're not going to make me.

Who, besides another drunk, likes a drunk? Oh well, we're talking social drinking, not drunk—right? No, it's a matter of degree, that's all. Even one drink makes you a little bit drunk. You reduce your ability to think, to coordinate. One drink and you are a worse driver and thus more likely to kill or maim yourself, your family, friends and others. The drug affects your thinking, making you resistant to reason.

Did you see the Richard Pryor movie where he talked about his drug addiction? Too bad—you missed a powerful, hilarious and terrifying, account of how it is from the drug addict's side.

Our educational system should prepare our kids to cope with the pressures they're going to experience—from the media—from peers—from criminals. They should be better able to cope with the enormous money pressures pushing tobacco, alcohol, cocaine, crack, heroin, uppers, downers, gambling and so on.

Okay already, there's a problem, so what's Dr. Green's solution? Well, I'm not one to bring up problems—even such severe ones such as these—without offering a practical solution. It's going to take one whale of a solution. We're talking about either fixing or replacing a public educational system which has been deteriorating for over a hundred years—with tentacles in every part of our country—a system supported by public taxes, both state and federal. This is a Very Big City Hall.

If we try to fight public education head on we're going to be fighting every branch of the federal government which can be brought into play. We're going to have congress, the administration, the courts, right on down to the local boards of education in your town ready for mayhem. I'm talking FBI, CIA, IRS, and every other initial combination you've ever heard of. That's one whopping City Hall!

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Guerrilla warfare might work—it's pretty successful around the world. But that's fighting the enemy from the flanks and the back. It's better than head on, but it's slow and painful. It also usually leads to frustrations which in turn bring terrorism.

No, what we need here is a sneaky new approach—one which can be built into a juggernaut before public education realizes what's happening. Yes, we have just what we need in the tools to make this happen. It has the added benefit of appealing to the profit motive. It's capitalism at work, fighting our decayed socialist public educational system. Capitalism has outperformed socialism and communism in every country of the world. There isn't one showcase for communists or socialists to point to with pride—and that certainly includes our socialized public school system.

Capitalism has, on the other hand, a growing number of phenomenal success stories such as America, Japan, Korea, Taiwan, Hong Kong, Singapore and so on. The difference between Taiwan and China is night and day, yet these two have exactly the same people—it's just the political system which is different.

Even the U.K., which was rapidly self-destructing under socialism, has been making incredible strides under Thatcher's management.

Money (power) is the driving force. It's why the drug "war" is being lost—indeed can't be won. It's why people are allowed to smoke tobacco in spite of everything we know about it—in spite of it killing 35,000 people a month just here in America. It's why we put up with our kids killing each other with drunk driving. Money will defeat altruism and good intentions every time.

We're at a particularly serendipitous time in our history. For the first time we have at hand the tools we need to come in from left field and topple public education. I'm not talking repairs, I'm talking our taking no prisoners. I'm talking our getting rid of the monster once and for all, but doing it so it never knows what hit it.

Schools apparently haven't taught the basics of freedom in ages, so few kids even have a sense of what it means. I used to be really angry at the federal laws forcing kids to go to school—mainly public school. I couldn't see the difference between that and slavery. I still can't.

Of course, I don't see the difference between the draft and slavery either—except that one is legal and the other isn't. We still condone legalized slavery of kids—and it's the first thing we think of when we need to build up the military...let's round up the slaves.

The main tool we have immediately available is video. With VCRs in most homes these days this is a simple and profitable entry for the New Education. The next step is to use an interactive educational medium such as interactive compact discs (CDI), but that's down the pike. It's too expensive right now. We might find a way to develop interactive video tape systems which would work with our present VCRs. In the meanwhile there's an enormous market out there right now for educational videos—a market which is virtually untapped.

The first videos should be aimed at adults to re-educate them. Until adults decide that education really is important for their kids, the kids aren't going to be motivated to bother learning. Oh, we can sugar-coat the educational system, making it fun to learn. That'll help and is long overdue. The slavery system of forcing kids (sometimes laughingly called "students") to sit through endless drudgery imposed by indifferent and ill-prepared people we call "teachers" has so deadened kids to the concept of education that we have our work cut out for us.

There is a good deal of anger at the newly arrived Asian kids who are running circles around good old-fashioned American kids. If you've watched TV, you know that the only real difference between these Asian geniuses and our dolts is that their parents don't take any baloney. Their parents have convinced their kids that education is important, so they're making the best they can of our sick system—and beating American kids at every turn. So first we have to educate the parents. Sigh! No, I didn't say this was going to be easy, just that it was important and would be very, very profitable. Money!

American parents, I believe, are ripe for this educational revolution. I believe they'll go for videos on how to help their kids succeed. That's one trait that hasn't been completely beaten out of us—we still hope our kids will be able to do better than we have. As we see them going for drugs, drinking, sex, cruising, petty theft, lying, and ignoring school, we know we've let them down—but we don't know just what we should have done. How did we fail them?

Every parent who's tried to deal with a kid on drugs, in jail, going off with the Moonies, turning gay or suddenly pregnant has asked where they've failed. They hear that it isn't they who've failed, it's the schools. Baloney. We've let our kids fail—and we've let our school system turn to pap.

Once we have some videos teaching parents how to parent we're going to need videos for the kids on how to kid. They'll need videos not only on every subject they've been short-changed on in school, they're going to need them on the subjects which should be being taught in school and aren't.

Can kids of ten understand videos on peer pressure? On personal ethics? On coming to grips with sex? Oh horrors, I can hear the religious groups screaming at me that sex should be taught in the home—or in church. Well, it isn't and it isn't going to be in any future now imaginable, so let's stop using this as a way to worm money out of gullible parents.

We see all kinds of video programs showing us how exciting crime can be. Yes, the criminals get killed, but we realize that in real life most criminals

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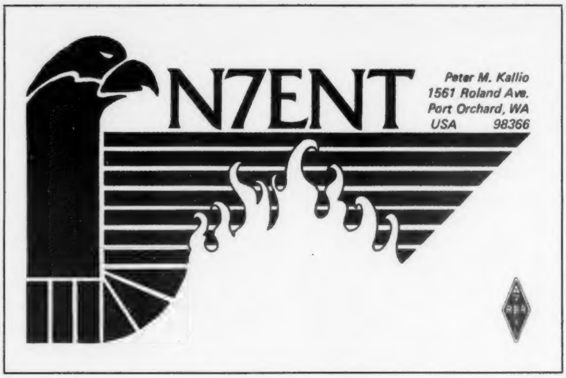

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get away with it—that this is just a distorted morality play we're watching. We read the papers, so we know that the average income for the crime syndicate people is over a million a year. We see the figures on how many tons of cocaine are smuggled into the country as compared to that stopped, so we know there are riches out there for the taking, no matter how badly the TV criminals end up.

Heck, we don't believe the TV cops either—except perhaps those on the Hill, who live on only in reruns.

We need videos to help parents learn how to educate their kids. We then need videos to help the kids cope with their problems—plus more to help them move ahead. Science videos could help kids come to grips with the fundamentals of electronics—and to get excited about amateur radio.

No, I don't think we can do it all just with videos. I think we need the print media to help, too. I have in mind monthly magazines for kids, aimed at each educational sector—electronics, geography, politics, language, reading, math and so on. Magazines can bring an immediacy which text books will never have. Magazines can bring previously dull subjects into focus and make them much more interesting.

How many school geography courses use the *National Geographic* as a text? How many bring in *The Scientific American* and discuss the articles? We have the basics already going for us, we just haven't seen them in that perspective.

With monthly magazine support we can get our kids interested in amateur radio, computer clubs, astronomy clubs, science fair projects, archaeological digs, local social programs, junior chamber of commerce. We can go back to the high school of my youth where we had over 120 after-school clubs from which to choose. Yes, that was 50 years ago, before the public educational system destroyed them. They're all gone now and my wonderful old high school was presented on TV a few years ago as one of the most dangerous schools in the country. What a testimony to public education!

I have a difficult time with things like this—things where obviously someone should DO something. I grouse about it. I look around to see if anything is being done. Then, out of frustration, if no one is going to do anything—I will. I get myself in all sorts of trouble that way. Sometimes spectacularly. Sometimes I pull a winner, as I did with getting repeaters accepted back in 1970, in getting microcomputers going in 1975 and compact discs in 1985.

I know what needs to be done. I know how to go about doing it. But it isn't anything I can do alone. I'm going to need all the help I can get. We're talking revolution here. We're talking about replacing a government $100 billion bureaucracy with $100 billion capitalist businesses. We're talking about tens of thousands of small businesses and hundreds of huge ones. We're talking about small firms making special videos. We're talking about mail order and video store sales and rentals. We're talking about advertising from national to local. We're talking a whole new type of teacher—one that's fun and exciting. In my whole time at college I had exactly one such teacher, so they're rare. There's one at Dartmouth teaching French.

We're not only talking the starting of magazines for each educational subject, we're going to need educational industry magazines to help these new products be rated and reach the customers. We're going to need writers, talent, video studios, music, editors, video duplicating plants, marketing firms, sales literature, advertising—the whole nine yards.

I'll be interested in your reaction. Some readers will come up with endless reasons why it won't work. Others will fight change to the bitter end. A few will say, hey, that's one heck of an idea, what can we do to help?

I like the idea because it doesn't take much to get started. And once it gets going, there isn't any way to stop it. Money talks. ■

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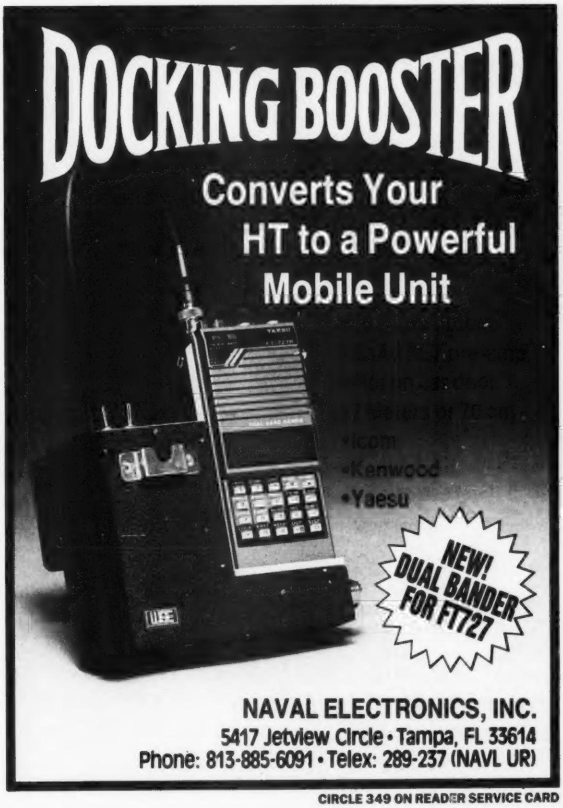
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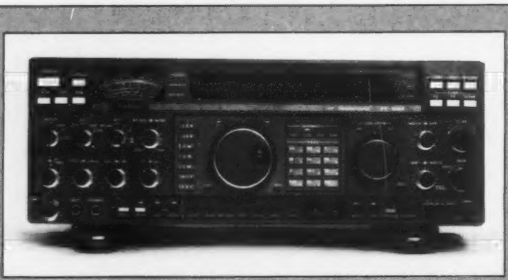
Compiled by Linda Reneau KA1UKM



PRODUCT OF THE MONTH

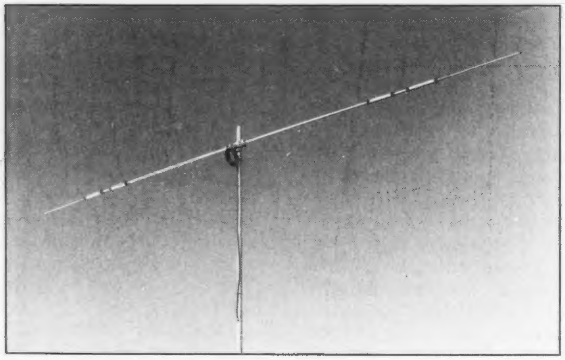
THE YAESU FT-1000

The FT-1000 was designed especially for DX operators. It has direct digital synthesis (DDS) for low noise and fast lock-up time. It also features adjustable 200W RF power output, built-in TCXO for frequency stabilization, independent filter selection, dual receive with balance control, and two tuning knobs for simultaneous reception.

Transmitter band range is 160–10m; receiver range is 100 kHz–30 MHz. Frequency steps are in 10 Hz or 100 Hz, depending on emission type. Maximum FM deviation is ±2.5 kHz. The FT-1000 offers three FSK and two packet shift frequencies.

Other features include a CW spot control, to align your frequency to the incoming signal without transmitting; direct keyboard frequency entry; front panel RX antenna selector; built-in cascaded filter, and dual-mode noise blanker. The receiver front end uses a four JFET up-conversion mixer.

The FT-1000 measures 420mm x 150mm x 375mm and weighs 25.5 kg. Suggested retail price, $3400. With options, $4400. Contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701. (213) 404–2700.* Or circle Reader Service No. 201.



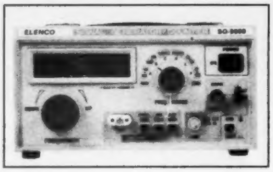
CUSHCRAFT CORPORATION

The Cushcraft D3W rotatable WARC dipole covers 30, 17, and 12 meters. You can easily mount it on any 1½–2 inch mast, with your tri-band and other antennas.

The D3W features automatic frequency selection, high Q traps, heavy wall tubing, and stainless steel hardware. It's 34′ long, weighs 11 pounds, and is rated for 2000 watts PEP.

Price, $200. Contact *Cushcraft Corporation, PO Box 4680, 48 Perimeter Road, Manchester NH 03108. (603) 627–7877.* Or circle Reader Service No. 205.

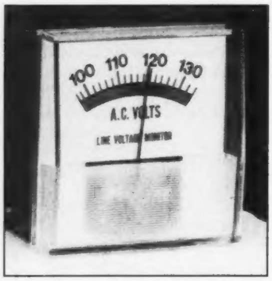
ELENCO ELECTRONICS, INC.



The Elenco SG-9500 signal generator/counter combines in one unit a generator able to put out frequencies from 100 kHz to 150 MHz, and a built-in, switchable frequency counter which measures external frequencies up to 150 MHz.

Features include: accuracy is 1 ppm; RF output 100 mV rms (up to 35 MHz); output control 0 dB–20 dB fine-adjustable switch; 1 kHz internal AM modulation; crystal oscillator HC-6/V holder; input voltage less than 50 mV; gate times selector 0.1 sec. and 1 sec.; and input impedance of 1Ω for HF and 50Ω for VHF.

Price, $350. Contact *Elenco Electronics Inc., 150 W. Carpenter Avenue, Wheeling IL 60090.* Or circle Reader Service No. 202.



MFJ ENTERPRISES, INC.

The MFJ-850 line voltage monitor protects against low voltage brown-out that can damage your equipment. Plug it in, and it tells you at a glance when your line voltage is at a brown-out level. The color-coded scale reads from 95–135V. Accuracy is ±2%. Leave it plugged in for constant monitoring.

The MFJ-850 measures 2¼″x2¼″x1½″. Use it in your boat or RV as well as in your ham shack. It's especially useful for checking portable and temporary electrical setups. Price, $20. Contact *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762. (601) 323–5869. Order at (800) 647–1800. FAX: (601) 323–6551. TELEX: 53-4590 MFJ STKV.* Or circle Reader Service No. 203.

PALOMAR ENGINEERS

Palomar
Model

Palomar Engineers announces a new series of high power baluns. Rated at 2 kW CW and 6 kW PEP, the Model MB baluns operate from 2–30 MHz. 50Ω input goes to a Teflon-insulated UHF connector (or an optional N-connector). Balanced output is to two cone insulators. Available output impedances are 50, 75, 100, 150, 200, 300, 450, and 600Ω. MB baluns, in cast aluminum cases filled with epoxy, are weatherproof.

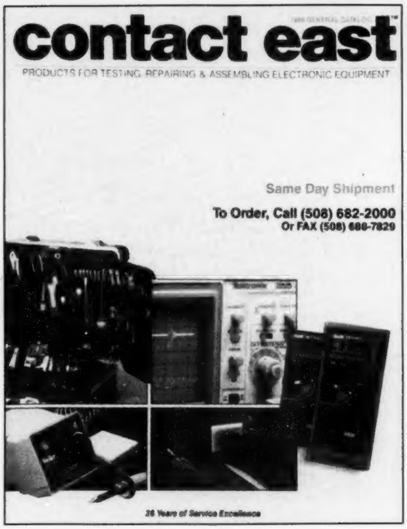
Prices range from $100 to $165. Contact *Palomar Engineers, PO Box 455, Escondido CA 92025. Phone (619) 747–3343.* Or circle Reader Service No. 204.

SYSPEC INC.

The OVP-12, an overvoltage protection network new from SYSPEC, is supplied as an "open" printed circuit board to facilitate mounting for various applications. Designed to protect solid state equipment 8–30V DC from damage caused by power surges, failures, transients, and spikes. Fast response ensures protection during momentary as well as sustained conditions of overvoltage.

The OVP-12 is connected across the unit, beyond the system fuse/breaker. When overvoltage occurs, the device triggers into the low impedance state and trips the fuse/breaker. You can mount the OVP-12 inside the power supply cabinet, inside the system, or as a stand-alone in a user supplied enclosure.

The OVP-12, 1 7/16″ x 2 1/16″, is priced at $25, including shipping. Order from *SYSPEC Inc., PO Box 2546, Syracuse NY 13220. (315) 699–7513.* Or circle Reader Service Number 207.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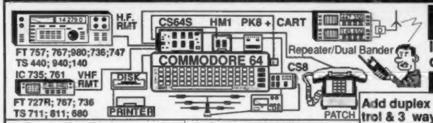
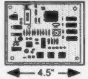
All products are described and illustrated in detail, with specifications, prices, and guarantee. Orders received by 3 PM are shipped by 5 PM. For your free copy of the *1989 General Catalog* and one year of technical supplements, write or call *Contact East, PO Box 786, 335 Willow St. So., North Andover MA 01845. (508) 682–2000.* Or circle Reader Service No. 206.





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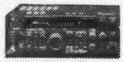

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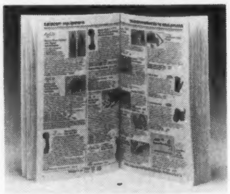

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Continued from page 15

and ground pins for the LM324 op amp. This chip uses pin 4 for power and pin 11 for ground. I used a wall mount 14V DC power supply regulated by a 7812 three-terminal regulator to power my device. If you do this, be careful. The wall mount power supply that came with my Uniden scanner has a three-prong grounded wall plug, and the DC ground is apparently referenced to the AC ground. This caused my error meter to peg low when I attempted to connect a scope or frequency counter to the test set that used a three-wire power cord. To solve the problem, I used a three-wire to two-wire converter on the scanner power supply to eliminate the ground loop between the scanner and the test equipment.

You can order suitable milli- or microammeters from Mouser Electronics. Ideally, the frequency error meter should have a 5-0-5 unit scale and the deviation meter a 0-6 units scale. This allows you to directly display up to 5 kHz of frequency error and up to 6 kHz of deviation. I designed the driver circuit for the meters to be flexible enough for much freedom in meter selection.

Calibration

If you have access to a service monitor, use it to tune up this device. If you invest a little time, you can generate a table of meter readings vs. actual conditions, and your test box will be a secondary standard to your service monitor.

If you're not lucky enough to have access to a service monitor, don't worry. You can use a new or recently calibrated transceiver equipped with both DTMF and subaudible tone encoders to use as a signal test standard. After you have carefully checked your construction work, turn on the power to the board. Use a voltmeter to test for power and ground in all the required locations. Ground the audio input and the frequency error meter should peg to the frequency low side. The frequency deviation meter should read zero.

If your board passes the above test, it should be safe to connect it to the scanner. After connecting the scanner, turn it on. The scanner should operate normally, as before. If it doesn't, turn the power off immediately and investigate. Once the scanner operates properly, adjust VR1 until the error meter oscillates around zero with no carrier present.

Connect your test transceiver to a dummy load, turn its RF power output down to minimum, and remove the antenna from the scanner. Set the transceiver and scanner to the same frequency and key the mike. Adjust VR1 until the error meter reads zero. With the mike still keyed, press "1" on the DTMF pad. DTMF encoders are set at ⅔ system modulation. For narrowband FM this is 3.3 kHz of deviation. Adjust VR2 until the deviation meter reads 3.3 kHz. Turn on the subaudible tone encoder and key the transceiver. Note the meter deflection, but do not make any adjustments. Subaudible tone signaling encoders are typically set to 750 Hz of deviation. For future reference, note this meter reading and the one made while setting VR2.

Set the transceiver frequency 5 kHz high. Key the mike and adjust VR3 until the error meter reads full scale high. Set the transceiver 5 kHz low and again key the mike. Ideally, the error meter should read exactly full scale low. Practically speaking, you will probably have to compromise between the frequency high and frequency low meter settings (this is where the not-quite-test-instrument-quality comes in). Your test box is calibrated. Now, what can you do with this little jewel?

Operation

When setting up a DTMF encoder, set the modulation to 3.3 kHz on the deviation meter. If you are adjusting the output of a subaudible tone encoder, set the modulation to the meter reading you obtained during calibration.

If you are using this test set for bench work, simply connect your transceiver to a dummy load, take the antenna off the scanner, and go to work. The leakage coupling between the two units is more than enough for testing. (Don't EVER connect the transmitter output directly to the antenna input of the scanner or you will destroy your scanner!) With the antenna installed, you can analyze any signal you can hear over the air.

The tests and measurements you'll be able to make with this simple, two-chip device will amaze you. I hope you enjoy using the Poor Man's Service Monitor.

Bill Crowl N6MWS, first licensed in 1985, also holds a Commercial Radiotelephone Operators license. Bill has spent the past nine years employed in the field of electronics, and is currently employed as a Sales Engineer for Selectone Corporation. He can be reached at 8157 Auberry Drive, Sacramento, CA 95828.

Continuous Tone Coded Squelch System

Subaudible tones range from 67–203 Hz, and are used by both transmitting and receiving stations for selective call operation. This system is called Continuous Tone Coded Squelch System (CTCSS). Hams often refer to this type of signaling as "PL," an acronym for "Private Line," Motorola's trade name for CTCSS. Subaudible tones keep a receiver quiet (even when a carrier is present) until the proper subaudible tone is received.

Tone access is often used on VHF amateur repeaters to prevent long distance skip signals from falsely activating a wide area coverage repeater. In commercial service it permits multiple groups of users to share the same RF channel without unduly disturbing each other.

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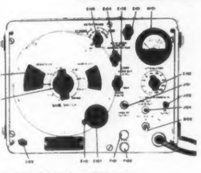
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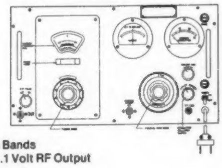
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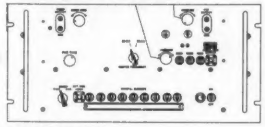
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OSCAR 9, 13 Troubles

During the early morning hours of October 9, 1989, the on-board computer (OBC) of AMSAT-OSCAR-13 crashed. Then, on Friday the 13th, the Dow-Jones Industrial Average took a nearly 200 point drop and UoSAT-OSCAR 9 re-entered the earth's atmosphere—unsuccessfully. It was not a fun week.

On October 9, many operators discovered that the workhorse satellite for enthusiasts everywhere, OSCAR-13, was not on schedule. Repeated attempts to use it failed. AMSAT bulletins carried the bad news: Cease attempts to use OSCAR 13 until further notice.

When OSCAR-13's computer crashed, the satellite automatically switched to Mode L beacon with output on 435 MHz. Later in the day, Peter DB2OS, OSCAR 13's primary ground-control station, sent a RESET command to the satellite. It then switched to Mode B transponder operation using the 435 MHz uplink receiver and 2 meter transmitter with the omnidirectional downlink antenna. All was not lost. The bird could at least accept ground-control signals, but the bulletins remained the same: All operation through OSCAR-13 must end till further notice.

Experienced satellite operators monitoring the crisis were quite concerned. AMSAT-OSCAR-10 has been uncontrollable for years due to computer memory failure, while the two UoSAT spacecraft were almost lost due to software problems early in their life. There were no obvious reasons for A-O-13's computer to fail.

Less than a day after going silent, the general beacon transmitted 400 baud PSK signals. The repeating message read DB2OS TELEMETRY PROGRAM V2.0 VIA VK5AGR. Graham in Australia, another designated ground-control station, had successfully loaded a short routine into the satellite's computer. Later, DB2OS loaded more software into the satellite. The high-gain downlink antenna was switched in and bulletins from AMSAT were optimistic. Although it took a few extra days to get transponder operation software loaded into the satellite's computer, the results were a great relief to satellite enthusiasts. On Friday, October 13, DB2OS declared A-O-13 operational and available for use. Although the schedule did not include any Mode S (70 cm up and 13 cm down) time, at least the satellite was working.

> *"RUDAK is a digital, packet radio transponder using four 23 cm uplink frequencies and a single 70 cm downlink."*

Why?

What caused the crash? Will it happen again? The malfunction could have occurred for any one of several reasons. A few possibilities include high solar radiation, which may have introduced a single-event upset in the processor circuit or a double error in the memory. Garbled commands or transponder schedule changes may have contributed. Hams around the world are to be commended for honoring the cease-operation request, and allowing designated ground-control stations the opportunity to try to make OSCAR-13 a functioning hamsat again.

The Descent of U-O-9

On October 16, through a University of Surrey announcement, Max White at the Royal Greenwich Observatory reported that U-O-9, the British scientific amateur radio satellite, re-entered the earth's atmosphere on Friday the 13th at 0752 UTC, somewhere over the South Pacific. This satellite had performed exceptionally during its eight-year life and nearly 45,000 orbits.

Launched October 6, 1981, on board a Delta rocket from the Western Test Range in Vandenberg, California, U-O-9 was built to promote greater interest in space engineering and science in schools, and to test novel technologies. Its downlink frequencies ranged from 7 MHz through 10 GHz. U-O-9 broadened the amateur satellite program by giving amateur experimenters and scientists around the world the use of a small, inexpensive, yet sophisticated educational spacecraft. Although U-O-9 will be missed, UoSAT-OSCAR 11 continues to perform similar duties and UoSATs D and E are scheduled for launch with the Microsats.

False Alarm

On October 14, OSCAR 13's Mode JL (2 meters or 23 cm up and 70 cm down) did not come on. Once again hamsat enthusiasts became concerned. This time their fears were quickly calmed when Mode B (70 cm up and 2 meters down) was activated when expected. An unannounced schedule change was responsible for the lack of Mode JL that day. New experiments by DK1YQ in West Germany with RUDAK (German acronym for Regenerative Transponder for Digital Amateur Communications) required the JL transponder system to be off.

RUDAK is a digital, packet radio transponder using four 23 cm uplink frequencies and a single 70 cm downlink. Due to unknown problems, the system has been unusable since OSCAR-13's launch. Further RUDAK testing in late October began to show results. Certain commands and software upload sequences worked after more than a year of failure. While this is progress, it is still uncertain if the experiment will become fully operational. Experiments by the RUDAK team in Munich will continue.

The on-board computer crash of OSCAR 13 and the demise of U-O-9 remind us that amateur satellites are a limited resource. Batteries fail. Solar panel output declines with age. Radiation damages memory circuits, and orbits decay. The best time to prepare for satellite operation is NOW. Those who wait for the ultimate geostationary hamsat will miss years of exciting operation via the current fleet of spacecraft.

RUDAK 2 Goes to the Soviet Union

Scheduled for launch in early 1990, RS-14 from the Soviet Union will carry the latest and most advanced version of the RUDAK digital communications system into orbit. Through connections to the Soviet amateur satellite program via Leo Labutin UA3CR, shown in Photo B (courtesy W6ATC), the West Germans have constructed a RUDAK system on four circuit boards to be mounted in the RS-14 spaceframe.

Uplink frequencies include 435.005, 435.050, 435.190, and 435.150 MHz. The common downlink will be 145.990 MHz. While details of the system are not yet available, it is known that uplink baud rates will range from 1200 to 9600 bits per second, using AFSK (audio frequency shift keying) on FM and other modes.

The 70 cm uplink and 2 meter downlink frequencies define a Mode B system. The analog transponder also on board RS-14 is expected to be at least 90 kHz wide with a similar uplink/downlink configuration to that of RUDAK 2.

From left to right: Valery UA3FH, Eugeny Labutin RA3APR, Leo Labutin UA3CR, and Nick UA3AIC.

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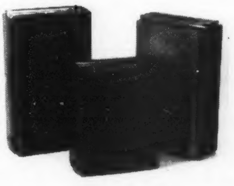

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

DEC 31, 1989

SOUTH BEND IN A Hamfest Swap & Shop will be held on Sunday, December 31, 1981, at Century Center, downtown on US 33 one-way between the Trustcorp Bank Building and the river. Tables: $5/5-ft. Round: $15/8x2.5-ft. Rectangular: $20/8-ft. Wall locations. Talk-in frequencies: 52–52, 99–39, 69–09, 34–94, 145.29. For more information, contact *Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616 or call (219) 233–5307.*

JAN 7 & JAN 13, 1990

RIO de JANEIRO, BRAZIL The 1990 Hunting Lions in the Air Contest is a worldwide project sponsored by the International Association of Lions Clubs and Coordinated by the Rio de Janeiro Arpoador Lions Club of Brazil to promote international relations between individuals. Nonlions are welcome to join. For complete rules, write *CONTEST COMMITTEE—HUNTING LIONS IN THE AIR, Rio de Janeiro Arpoador Lions Club, PO Box 2155, Rio de Janeiro 20011, RJ., BRAZIL, South America.*

JAN 13, FEB 24

APPLETON WI The Fox Cities ARC Winter Banquet will be at the Roosevelt Jr. High School at 8 PM on the 13th.

The Club will sponsor HAMFEST 1990 at Sabre Lanes, Menasha, on Feb. 24th. Contact *Don Baker NB9J, 621 W.7th St., Kaukauna WI 54130. (414) 766–3886.*

JANUARY 17

PHILADELPHIA PA N3KZ, the University of Pennsylvania ARC will operate on the above date from 1600–2000 in celebration of Benjamin Franklin's birthday and the 250th year of the university, which was founded by Franklin. 14.250 MHz. For commemorative QSL, send #10 SASE to *W3KRB, 1207 Waverly Road, Gladwyne PA 19035.*

JAN 21

SOUTHFIELD MI The Southfield High School ARC is sponsoring their 24th Annual Swap & Shop at the Southfield High School. Doors open at 6 AM for exhibitors. Open to the public at 8 AM to 3 PM. Admission, $4. Children 12 and under, free. $12 for one 8-ft. table, paid in advance. 350 tables. This is Michigan's largest Swap & Shop. Parking, door prizes. All profits will support Electronic Scholarships and Southfield's High School ARC. Contact *Robert Younker, Southfield Senior High School, 24675 Lahser Road, Southfield MI 48034. (313) 746–8675.*

JAN 27

ST. LOUIS MO The St. Louis Repeater Club will sponser the "Winterfest" at the Stratford House just west of Interstate 270, on Interstate 44. Free parking. Admission $1 per adult, children under 12 free. Features include over 6000 square feet of indoor flea market; VE exams; refreshments. 8-ft. tables, $5 each. Advance reservations required. Talk-in on 146.31/.91. For more information, call *James Berger WA0FQK at (314) 351–7732.*

JAN 31–FEB 4

HOUGHTON MI Michigan Technological University ARA (MTU-ARC) will operate W8YY on the above dates to celebrate the university's Winter Carnival. Suggested frequencies: CW—1.805, 3.550, 7.050, 14.050, 21.050; phone—1.850, 3.875, 7.250, 14.250, 21.375, 28.450; packet—145.01. Alumni especially encouraged to call. For certificate, send QSL and large SASE to *W8YY Amateur Radio Club, Wadsworth Hall, Houghton MI 49931.*

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LETTERS

From the Hamshack

SF Earthquake

Less than an hour and a half after the San Francisco earthquake, I was listening on the amateur radio bands and I was very impressed by the rapid response from my fellow radio amateurs. There must have been at least thirty or forty controllers on various frequencies handling traffic, answering questions as well as they could, and taking phone numbers to try to alleviate anxiety. Most of the queries were from nonhams who had managed to get in touch with an amateur in their vicinity. As an ex-Naval and civilian radio officer, I was very impressed with the order the controllers managed to impart, and the adherence to emergency procedure.

It's a good thing to know who your neighborhood ham is. I hope the media took the time to listen on the 15 and 20 meter bands that Tuesday night. It was incredible. Hams were active and working so quickly I venture to say they were better organized than the professional services. Thank you to all my fellow hams.

Reg Baldock VE7ABF
Clearbrook BC Canada

"Even before the shaking stopped, ham radio operators were establishing communication links with the San Francisco area. Hundreds of volunteers, many staying up all night, pinpointed and communicated information about need for emergency services, damage reports, and handled health and welfare inquiries to and from the area.

"The major ham radio FM communication link between Northern and Southern California is the Condor system of several linked repeaters. This system, built entirely by hams at their own expense, is very reliable . . . it handled continuous high-quality emergency communications throughout the nights and days following the San Francisco earthquake. It did the same after the Whittier quake.

"Condor uses the lower end of the 220 MHz ham band to connect its repeaters. Under very suspicious and unusual circumstances, the FCC recently ruled that the use of this spectrum of frequency (220-222 MHz) will be taken away from the hams and made available to commercial business interests. The loss will be a major one to the brilliant and dedicated hobbyists who built the system, but it will be an even greater loss to the citizens of California when the next disaster strikes."

Alan Ginsburg
Seal Beach CA

[reprinted from the *L.A. Times*]

When the news media turns to ham radio for coverage of a natural disaster, hams have a golden opportunity to show off their preparedness. But the irresponsible ham can also wipe out this opportunity.

During the San Francisco earthquake, we had everyone from national TV to the local cable network and the newspapers looking over our shoulders at my Costa Mesa station, picking up the unique capabilities of hams to stay on the air after "the big one." But all this good PR was wiped out by a ham letting his frustrations out on the air about the jammers and tuner-uppers. It's irresponsible to air our dirty laundry!

Unquestionably, we'll always have those who make life rough for us as we're handling emergency communications or showing off ham radio to the news media. If we give in to these lids, we give ham radio a black eye and these disruptive operators the spotlight they're looking for.

When the cameras are running and the tape is rolling, I don't let them catch on that a tuner-upper or jammer has clouded up the emergency communications. I either QSY or calmly talk over the QRM, and everything sounds great to the news media. We portray most ham radio communications as they really take place on the airwaves.

When the news bureau calls and wants to visit your shack, show them the best of ham radio. Figure out a way to quietly air your frustrations about the occasional lid that may not understand that a steady carrier could very well cost a life. Let the news media see ham radio the way it usually is when it comes to life-saving and public service communications.

Gordon West WB6NOA
Cosa Mesa CA

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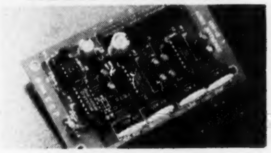

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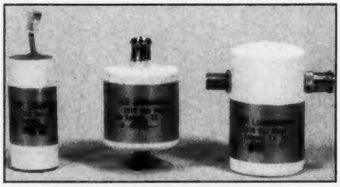

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CIRCLE 38 ON READER SERVICE CARD

Number 31 on your Feedback card

73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

HUGO! *Even though you will be reading this several months after Hurricane Hugo devastated many islands in the Caribbean, ham radio operators are still providing communications services for the health and welfare of those islands.*

What makes people give up their free time to spend hours, days, and months at the radio helping others? For those of you helping your fellow man regardless of race, color, or creed, I salute you. Keep up the good work!

Roundup

Brazil From Felipe PY2VRX and Sergio PY2NTD comes a list of new amateur radio beacons. The three beacon callsigns and addresses are: PY2AMI, Box 31, ZC 13.470, Americana, Sao Paulo, Brazil; PT8AA, Box 149, ZC 69.900, Rio Branco, Acre, Brazil; PT7ACC, Box 975, ZC 60.000, Fortaleza, Ceara, Brazil. [*Look for the frequency listings on the 73 BBS (603-525-4438, 8-N-1).—CCC*]

Japan From the *JARL News*: HAM FAIR '89, a three-day festival sponsored by JARL last August, was considered a huge success again. HAM FAIR is recognized as the largest amateur radio event in the world.

Frank L. Striegl 7J1AAL was at the IARU Region 3 meeting and dinner in late August as a representative of the Tokyo International ARA. Frank reports that two Deputy Secretaries General of the Chinese Radio Sports Association, also present, had recently received their (first) INDIVIDUAL callsigns. This is a big step in China, where there are only some 37 CLUB stations. The individuals are Mr. Cheng Ping BZ1CP and Mr. Wang Xun BZ1WX.

Liberia H. Walcott Benjamin EL2BA, IARU Liaison Officer for the Liberia RAA, announces there are three new counties in Liberia, making the total thirteen. They have modified their "Work All Liberia Award" Rules and Map of Liberia. Contact the Liberia Radio Amateur Association, PO Box 987, Monrovia, Liberia.

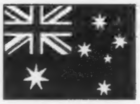
[*Liberia now lists six awards in their program. Details on the 73 BBS.—CCC*]

South Africa From the *SARL Bulletin* compiled by ZS6AKV and ZS1VP, and submitted by ZS6ET, comes the announcement that Leroy Dale ZS6XJ has received five separate Worked All Britain Awards Group (WABAG) awards for contacts on the 6 metre band. As the first South African to claim one of their awards, the Oxford Group also awarded ZS6XJ a certificate in recognition of outstanding services to the WABAG.

New Zealand From Radio Sweden. DX MEETING–A convention of SWLs and DXers will be held near Auckland, New Zealand, during the Easter Holiday weekend April 13 to 16, 1990. The local branch of the N.Z. Radio DX League will host the convention at a beautiful coastal location 60 kilometers north of Auckland. 1990 is a special year for New Zealand, with celebrations including 200 years of European settlement and 150 years of nationhood. You can write Douglas Doull, Box 3011, Auckland, New Zealand for further information.

Calendar for January

1—New Year's Day, USA; Independence Day, Haiti, Sudan
2—New Year's Holiday, Scotland; St. Berchtold's Day, Switzerland
4—Independence Day, Burma; Martyrs' Day, Zaire
6—Feast of the Epiphany
7—Ethiopian Xmas, Ethiopia, Egypt
9—Martyrs' Day, Panama
10—Yukichi Fukuzawa, 1835
11—Anniversary Day, Albania
12—Moswehswe, 1785; Revolution Day, Tanzania
13—Pongal Sankranti, Hindu
14—Albert Schweizer
15—Adult's Day, Japan; Dr. Martin Luther King, Jr.'s Birthday, USA
17—Benjamin Franklin, 1706; Anton Chekov, 1860
18—Revolution Day, Tunisia
19—Paul Cezanne, 1839; Archbishop Makarios Name Day, Cyprus; Epiphany, Julian Calendar
20—National Heroes Day, Guineau-Bissau
21—Our Lady of Altagricia, Dominican Republic; Death of Lenin, USSR
22—National Holiday, Australia
23—Hideki Yukawa, 1907
24—Economic Liberation Day, Togo
26—Anniversary of the Proclamation of the Republic, India
27—Wolfgang Amadeus Mozart, 1756; Lewis Carroll, 1832; Franz Kafka, 1883; Chinese New Year Tet (Vietnamese)
28—Jose Marti, Cuba
29—Martyrs' Day, Nepal
30—Franklin D. Roosevelt, 1882; Vasanta Pachami, Hindu
31—Independence Day, Nauru



AUSTRALIA

Ken Gott VK3AJU
38A Lansdowne Road
St. Kilda, Vic. 3183
Australia

Our Department of Transportation and Communications (DOTC) has announced that the amateur service is now the primary service on two of the WARC bands, 18.068–18.168 MHz and 24.890–24.990 MHz. Previously we could operate on these bands, provided we avoided certain spot frequencies.

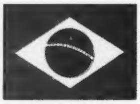
The DOTC has also eased restrictions on amateur use of the lower half of the 50–54 MHz band. Although most of the transmissions of a government TV service on this band have been shifted to other spectra, its residual operations on VHF have caused severe restrictions on amateur use of, specifically, the 50–52 MHz section.

Government regulations in VK allow amateurs to have multiple callsigns. A recent WIA check of its records revealed one amateur who holds eight separate licenced callsigns.

Photo A. L-R, Claudio PY1DFF/CE0, Sergio CE0ICD, Rosa Roja CE0MTY, unknown.

[*And some USA hams just want one extra callsign.—CCC*]

Due to miscalculation, results from the VK contest Championship for 1988 have been revised: VK5QX and VK3AJU were equal winners, each getting a duly inscribed plaque.



BRAZIL

Carlos Vianna Carneiro PY1CC
Rua Alfonso Pena, 49/701
Rio - R.J. - Brazil
CEP 20270

JUAN FERNANDEZ ISLANDS PY1DFF/CE0

It took almost one year for Claudio R.S. Pinto PY1DFF to set up an operation from Chilean Juan Fernandez Islands. A strong mood for adventures, plenty of fair play, CWP Coordinator (Petropolis CW Group) and a deep radio amateur spirit, this is our Claudio PY1DFF/CE0 DX-peditioner.

Juan Fernandez Islands, 350 miles off Chile's coast, in the South Pacific Ocean, was always both a dream and a challenge to Claudio, who named 1988 as Juan Fernandez DX-pedition year, helped by complete and precious information from Pagianotiis friend CE3DEK, in Chile.

Landing at Santiago de Chile November 30, and then flying to Juan Fernandez Airport December 2, brought Claudio to Robinson Crusoe Island aboard a small Cessna plane. Only very skillful pilots are allowed to do these flights.

San Juan Bautista village, Claudio's operating site, was a four km walk down mountains and a near three hour trip across Del Padre Bay.

Continued on page 84

Number 35 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS, (1200 baud, 8 data bits, no parity, 1 stop bit, (603) 525–4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

I'm looking for information on the Radio Shack TRC 451. Need all the help I can get. Thank you. *John H. White KB6LJL, 1305 W. Fir Ave., Oxnard CA 93033.*

I need an operating manual and schematic for a Dentron GLA 1000B Amplifier. I will pay copying costs, copy and return the original. Thank you. *Hal Schweikart WB3JDP, 753 Yeadon Ave., Yeadon PA 19050.*

I built the synthesized 2m transmitter that appeared in the September 1980 issue of *QST* and in the 1986 *ARRL Handbook*. All parts are working except the VCO. Can anyone show me how to properly construct this 144 MHz VCO? I'm also looking for manuals for a Knight 6m transceiver, Model #TR-106. Help! *Duane Isaacson, ARS N0KMX, RR #1 Box 88-A, Iowa City, IA 52240.*

Fifteen Novices have recently graduated from Amateur Radio School at Louisiana State University in Shreveport, Louisiana! We need equipment now—new and used. *Bill and Dee Dee, Route 3, Box 704, Ringgold LA 71068. (318) 894–9224.*

I need a WACOM DUP 641 or 642 duplexer. Would greatly appreciate any information. *Dick Ber KB5BBU, 9617 Vista View Dr., Austin TX 78750.*

Wanted: Any information about WWV Receiver from Specific Products, Los Angeles CA. Will pay. *Orlo Hudson W5LVA, PO Box 968, New Strawn KS 66839.*

I have a circuit board and some parts for an alarm system marked "WD5HSN." I'm looking for a schematic and parts list. I'm also looking for a supplier of Calcutta bamboo poles for my quad antenna. *Judson White WA2PMH, 50 N. Greenwood Ave., Hopewell NJ 08525.*

Need manual for Semitron Transistor Tester and Set Analyzer, Model 1000. Will pay reasonable copying costs. Thank you. *Jack H. Christilaw KO8I, 38700 Ann Arbor Trail, Livonia MI 48150.*

Need schematic diagram for Ten-Tec Model 262G power supply. Will pay copying and postage costs. Also need source for service manual for a Santec Model HT-1200 2m HT. Thanks. *Scott A. Littfin N0EDV, 28579 County Road H., Webster WI 54893.*

Wanted: An operating or service manual for Yaesu FT-224. Will pay copying/postage costs. Also looking for memory expansion board for Tandy 1000A. *Edward Moiser N8IOV, 4376 Coolidge Rd., Coleman MI 48618.*

Schematic and service manual wanted for Pace Communicator II 2m FM transceiver. Will pay copying and postage. Thank you. *Jack Cox KA4OTB, 324 Bunker Hill Rd., Belleville IL 62221-5766. (618) 233–9048.*

Has anyone converted a Kenwood TK-200 to 2m? Contact *Q.R. Galbraith, 4303 Kingsway, Farmington NM 87401.*

I'm interested in what I think is called a Super Radio just for AM reception. *John Crowell, Star Hill Rd., Remsen NY 13438.*

I need a schematic and service manual for a Galaxy III transceiver built in 1964 by World Radio of Iowa. Pay for copy or copy and return. Thank you. *James Crawford NY5Y, PO Box 643, Lovington NM 88260.*

Wanted: Manual and schematic for Azden PCS 5000 2m FM mobile transceiver. Will pay copying, postage. *Keith Frankland KB0CNE, 711 Bellevue Blvd. N., Bellevue NE 68005.*

Wanted: Vidtex Communications Program for Radio Shack Model 4 computer. Will pay costs. *Bill Nelson N2GGQ, 52 Dykes Park Road, Nanuet NY 10954.*

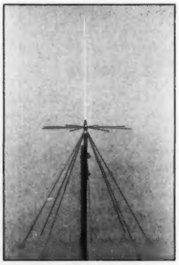
Wanted: Operating manual and any info for the Realistic DX-160 SW receiver. Will pay costs. Write first. *James G. Malta N2HOQ, 5263 Deborah Drive, Piscataway NJ 08854.*

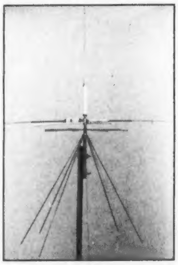
Need schematic for a AccuKeyer memory board or kit. Also need a schematic for a Hayes Smartmodem 1200B. Will pay costs. *Arthur Haug WA3ZMH, RD#3 Box 413B, Coopersburg PA 18036.*

I'm in search of a substitute or replacement IC-1 for the PLL board in an ICOM 22S. Part number is TC5080P and it appears to be a divider. Scrap PLL units welcome. Will pay costs. *Craig Newman KA1XB, RD #2 Box 109A, Jericho VT 05465.*

Wanted: Manual and/or schematic for AMECO Model TX-86 transmitter. Will pay costs. *Chuck Caruso, 10432 Manzanillo NE, Albuquerque NM 87111.*

Is there a company making kits for HF, all-mode SSB transceivers, and also VHF and UHF, even if crystal-controlled? Is VHF 2m and 220 MHz still available from Hamtronics? Thank you. *Mr. Vinson T. Ngo, 1111 Aguilar St., Cor., C.M. Recto Ave., Gocheco Bldg., R-320, Tondo, Manila, Philippines.*





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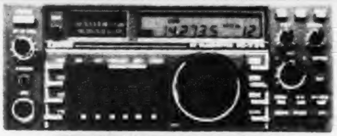

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CIRCLE 272 ON READER SERVICE CARD

Photo B. Rod Hallen 5Z4BH/KB7NK, Nairobi, Kenya.

Single dipoles for 10/15/20/40 and 80 meters were raised, together with a multiband. The first call, in spite of extremely bad conditions, caused a heavy pile-up, splashing for 10 kHz each side of the calling frequency. About 4,500 QSOs with 88 countries and 5 continents rewarded our efforts on this marvelous DX-pedition.

Electric power was available only 8 hours a day, so batteries helped furnish some two extra operating hours at night. There was very heavy QRN due to the dampness and rainy weather. Daytime conditions were extremely bad during the operation from Robinson Crusoe Island in the Juan Fernandez Islands from 3–10 December 1988. Close to 300 Brazilian stations were QSOed, a fine result! The place is beautiful as paradise must be, glorious nature all around, weather prediction and lobster fishing being the main activities, together with a responsible ecological defense of all animal and nature's species, rainbow colored flowers anywhere by.

Claudio thanks all for the brotherly reception from Chilean radio amateur friends from CE3AA Radio Club, from CE0CRC local Robinson Crusoe's members. A very special "HELLO!" to Sergio CE0ICD and Rosa Rojas CE0MTY at that unforgettable San Juan Bautista village on Robinson Crusoe Island.

A former volcano island, Juan Fernandez Islands were named after the Spanish captain who discovered them in 1574.

All base support for this expedition was given by Petropolis CW Group, by Rob PY1ROB, Baroni PY1HBS, and Claudia PY1TCV. Any information needed, write: CWP, PO Box 90415, Petropolis—R.J.—Brazil, CEP 25621.

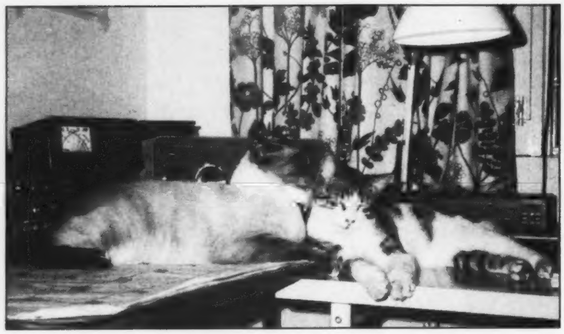

Photo C. Extra ops that keep 5Z4BH's operation purrfect.

KENYA

Rod Hallen 5Z4BH
Box 55
APO New York 09675

Many exciting events have happened since the last time I wrote. First, Dick Baldwin W1RU, the newly re-elected President of the IARU, spoke at our monthly meeting of the Radio Society of Kenya (RSK). We took him out to eat at Nairobi's Carnivore Restaurant, which must be the world's largest Bar-B-Que. Every kind of meat imaginable is sliced from the spit right at your table onto a red hot iron platter. Besides more usual meat, there are usually exotic selections. On this occasion we had hartebeest and ostrich.

Dick gave a course to the senior officials of Kenya's Post and Telecommunications Corporation responsible for Amateur Radio Licensing. This course takes the regulations of the International Telecommunications Union and helps to apply them to domestic communications requirements. Of course, if it also stresses the advantages of Amateur Radio to the government at the same time, that's all right, too.

Dick feels the officials were quite receptive. The RSK hopes for a Novice-type license to encourage Kenyan nationals to become hams. He strongly suggested that the RSK initiate a training program for would-be hams.

I have traveled to 5R8, 3B8, S79, 5H3, T5 and 9X5 recently. I operated from the QTH of Tom 5H3TW and Jon 9X5AA. I also had an eyeball QSO with Roul 5H3RB in Dar es Salaam and Dick S79D in the Seychelles.

I'm enjoying RTTY very much and made more than 1300 contacts in 1989, mostly on 10 and 15 meters, my favorite bands. I finished first for Kenya in the ARRL RTTY Roundup in January '89. I also entered the SARTG RTTY Contest and think I did fairly well.

I travel a great deal, but when I'm home stateside hams can usually find me around 21.090 MHz between 1800 and 2100Z. Props are almost always very good to the states at that time. Long path conditions on 20 meters to the Western and Central US have been great around 1300 to 1400Z.

I've had many requests for 40 and 80 meter contacts. I live in a townhouse and the antenna for those bands is a G5RV inverted-V with the peak about 12 meters above the ground just below my Cushcraft A3. I've made many contacts with Europe, Asia, Africa and Australia on 40 meters. The SWR is high enough on 40 meters to cause my TS-430S to cut its power output to about 30 watts, but I still manage to get through. The SWR is way too high on 80 meters, and I don't have an antenna tuner to correct the match. I did make contact with Carlos TI2KD recently for my first North American 40 meter contact.

That's all from Kenya for now. 73 & 88. 73

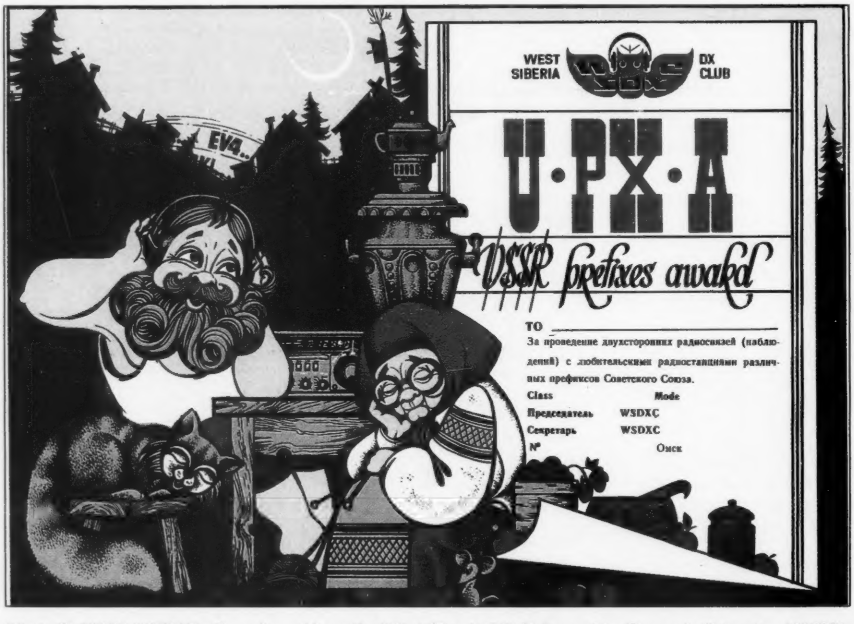

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Photo D. UPXA USSR Prefixes Award from the West Siberia DX Club, sent by Gennady Kolmakov UA9MA. These awards are 8½" x 12" in size, very suitable for framing.

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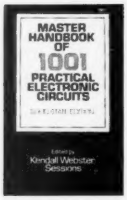

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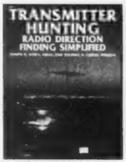

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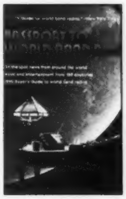

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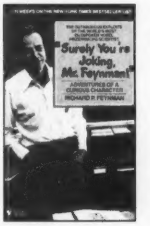

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
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Payson AZ 85541

From Bad to Better

HF band conditions are expected to be generally disturbed for the first half of the month with poor conditions concentrated between about the 4th and the 14th. Atmospheric and geological upsets could occur in this period as well.

On a day-by-day basis, anything can happen.

Gradually, things will improve from about the 15th toward the end of the month, with good propagation worldwide.

Although propagation this month is not generally as good as it is in the spring and fall months, the peak of the sunspot Cycle 22 is rapidly approaching, and solar flux levels will be very high. Because of this, ionospheric disturbances may be sudden and frequent. Your best guide will be WWV at 18 minutes after each hour. Overionization can occur on many days, causing signal absorption on the higher-frequency bands.

Because of the low noise levels in the northern hemisphere's winter, the 160, 80, and 40 meter bands will be quite active during the hours of darkness, and many DX records could fall, as long as magnetic field activity is quiet.

While bands above 20 meters will close shortly before or after dark, the bands below 20 will begin to "shine." During many *days* of the month, you can make some rare contacts on the bands between 30 and 6 meters. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	—	—	—	—	20	20	15	15	—	—	15
ARGENTINA	15	15	15	20/40	20/40	—	—	—	—	—	10	10
AUSTRALIA	15	15	—	—	20	20/40	20	20	—	—	—	—
CANAL ZONE	15	20	20/40	20/40	20/40	20	20	20	15	15	10	10
ENGLAND	40	40	40/80	40/80	40/80	—	—	10	10	15	20	40
HAWAII	15	15	20	—	40	—	—	—	—	—	—	15
INDIA	15	20	—	—	20	—	—	—	—	—	—	—
JAPAN	15	—	—	—	—	20	20	15	15	—	—	15
MEXICO	15	20	20/40	20/40	20/40	20	20	20	15	15	10	10
PHILIPPINES	20*	—	—	—	—	—	15	—	—	15(1)	15(1)	—
PUERTO RICO	15	20	20/40	20/40	20/40	20	20	20	15	15	10	10
SOUTH AFRICA	—	40	—	20	20	—	—	15	15	15	—	—
U.S.S.R.	—	—	—	—	—	—	20	15	20	20	—	—
WEST COAST	15	20	40/80	40/80	40/80	40/80	80	20	10	10	10	10

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	—	—	—	40	20	20	20	—	—	—
ARGENTINA	10	15	20/40	20/40	—	—	—	—	—	—	15	10
AUSTRALIA	15	15	15	20	20/40	20/40	20	20	—	—	15	—
CANAL ZONE	15	20	20/40	20/40	20/40	20	20	20	15	10	10	10
ENGLAND	—	—	—	—	—	—	20	15	10	15	20	—
HAWAII	15	15	15	20	20/40	20/40	—	—	20	—	—	15
INDIA	15	20*	20	20(1)	—	—	—	—	—	—	—	—
JAPAN	15	15	—	—	—	40	20	20	20	—	—	—
MEXICO	15	20	20/40	20/40	20/40	20	20	20	15	10	10	10
PHILIPPINES	15	—	20(1)	20(1)	—	—	20	20	15	15	—	—
PUERTO RICO	15	20	20/40	20/40	20/40	20	20	20	15	10	10	10
SOUTH AFRICA	—	—	40	20	—	—	—	—	15	20	—	—
U.S.S.R.	—	—	—	—	—	—	—	—	—	20	20	—

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	—	—	20	20	20	20/40	—	20	15	—	15
ARGENTINA	10	15	15	15	20	—	20	20	—	—	—	10
AUSTRALIA	10	10	15	15	20	20	20/40	20	20	—	—	—
CANAL ZONE	15	15	20/40	20/40	20/40	20	—	15	—	—	10	10
ENGLAND	—	—	—	—	—	—	—	—	20	15	20	—
HAWAII	10	15	15	20	20/40	20/40/80	20	20	—	—	15	10
INDIA	—	—	15	—	—	—	—	20	—	15	—	—
JAPAN	15	—	—	20	20	20	20/40	—	20	15	—	15
MEXICO	15	15	20/40	20/40	20/40	20	—	15	—	—	10	10
PHILIPPINES	—	—	—	—	20	20	20	20*	15	15	—	—
PUERTO RICO	15	15	20/40	20/40	20/40	20	—	15	—	—	10	10
SOUTH AFRICA	—	—	—	20	20	—	—	—	20	15	—	—
U.S.S.R.	—	—	—	—	—	—	—	20	20*	20	—	—
EAST COAST	15	20	40/80	40/80	40/80	40/80	80	20	10	10	10	10

JANUARY 1990

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-P	2 P	3 P	4 P	5 P-F	6 F-P
7 P	8 P-F	9 P	10 P	11 P	12 P-F	13 P-F
14 P-F	15 F-G	16 G	17 G-F	18 G	19 G	20 G
21 G	22 G	23 G-F	24 G-F	25 G	26 G	27 G-F
28 G	29 G	30 G	31 G			

Number 33 on your Feedback card

. . . de K6MH

I don't know why hams do it, knocking themselves out to build and maintain, at their own expense, the most advanced and intricate, really exquisite communications systems. Amazingly sophisticated repeater complexes with multiple inputs and outputs. Wide area nets. And now super high speed packet nodes. Why? Why do it? What's the percentage in it? What makes Sammy run? What makes hams do this?

Now and then, like when I was coming through Dayton a while back, I catch a glimpse of why it might be, just a little piece of a picture, like a haunting scene from a half-remembered dream.

Remember the great monolith that was floating in space in the movie *2001*? It reminds me of that. When this great "thing" was about to unleash its anciently-conceived program, folks got the message: "Something wonderful is about to happen!" That's what the present state of ham radio feels like to me.

There was a glimmering of it when I was a teen-ager. One summer a ham moved in up the street from me and I actually got to go into his shack and talk to California from this little basement in Dayton, Ohio. Immediately, I borrowed a paper-tape code sending machine, practiced unflinchingly for two weeks until FCC exam time over in Columbus and went there and GOT IT! Holy Smoke! I was one of these guys. If you don't know the thrill, well, you just don't know it.

This was something fantastic. But why?

What was it all for? And now, another 40 some years down the line, with dozens more really exquisite communications problems posed and solved by hams, on their own time, at their own expense, why?

Something wonderful is about to happen. Or am I just dreaming?

Dayton Repeater

A prelude to it happened along about midnight on a hilltop in Indiana.

I'd been scanning 2-meter FM on my little Yaesu HT and logged in about 47 different repeaters. Wow! Ham radio heaven! You know the feeling? But still the question, why?

Then on just about the lowest channel I had logged in, I found a net in progress. People were checking in, maybe a dozen, and at the invitation, I popped in with my call and joined the list. Nothing unusual. I wondered in how many other places across America this was happening.

After a few minutes of formalities, the net control op asked for topics.

OK, let's see what comes up. No-code, naturally. High cost of health insurance. It figures. One or two others. I forget what I asked.

Then we got into it, tossing the ball around. I don't remember how, but it started getting really good. This net was really getting off the ground! The feeling of excitement from way back in my teens, a pride of membership in this family of unseen friends, started welling up. Only this time here I am a grown-up, with some ease, some language skills, and voilà! A lot of the mike-fright was gone. Something real easy started happening. Real human beings started talking and listening. What did we talk about? Essentially we talked about just that. . . we talked about what do we talk about, we hams, and why? We talked about talking about what we really care about, instead of QSO by numbers ('73' included).

People started coming out. Some hung back a little, holding on to their security "we" blankets, and their list of standard messages. But it sounded like such fun, more people started jumping in. Hey, these people are really talking! Something ancient, or timeless was in the air, or on the air. People were dropping their armor, tossing off their hats, slipping out of their shoes. It started feeling like a session around a campfire. Passing it on to the next person became like solemnly passing along the "talking stick" in a Native American council. One talks, others listen. I mean, really listen. When you have whole attention like that, you're either going to run and hide, or relax into it and let it draw from you wisdom you didn't know was there. . . not something you knew before, the usual things you find yourself saying, but thoughts you didn't know and hadn't thought before.

Here this was happening on my beloved, beleaguered, sort of nerdy ham radio. Wow! It took me back to a feeling I had in the Upper Ojai Valley at the end of a grueling 3 hours in a sweat lodge, stepping out into cool, clear air, under the stars. A chant built up, and rolled through the night, over and over:

We are an Old People
We are a New People
We are the Same People
Deeper than Before

"OK, guys, fine business on all that talkin' stuff. I don't think there's much I can add to that. Anyway, I gotta run cause the XYL and the harmonic need a ride downtown. 73. See you later. Be lookin' for you on down the log."

. . . de K6MH 73

Compare...Ours & Theirs

Choosing the radio that's right for you can be pretty confusing. That's why we decided to make it as simple as possible for you to see how these Yaesu hand-helds stack up against the competition. No boasts, no sales pitches, just a factual side-by-side comparison of "ours" versus "theirs." Because Yaesu quality speaks for itself.

2 METER HANDHELD SPECIFICATIONS	YAESU FT-411/811	**ICOM IC-2SAT/IC-4SAT**	**KENWOOD TH-215/TH-415**
Memory Channels	49	48	10
VFOs	2	1	1
Memory Channels Store Any Offset	49	10	10
Wide Receiver Frequency Range (MHz)—VHF	140-173	138-174	141-163
Wide Receiver Frequency Range (MHz)—UHF	430-450	440-450	438-450
Built-in CTCSS Encode/Decode	Included	Option	Encode Only
Memory DTMF Autodialer	10	None	None
CTCSS Paging	✓	Option	—
Programmable Battery Saver	✓	✓	✓
Backlit LCD Display	✓	✓	✓
Backlit DTMF Keypad	✓	—	—
APO, Automatic Power Off	✓	✓	—
1 MHz Up/Down Stepping	✓	✓	✓
Vinyl Case	✓	Option	Option
Scan For CTCSS Tone	✓	—	—
Built In VOX	✓	—	—
Clock	—	✓	—
Odd Split, Any Tx Or Rx Frequency In Any Memory Channel	49	10	1
Suggested Retail Price	$406.00*	$439.95*	$349.95*

DUAL-BAND HANDHELD SPECIFICATIONS	YAESU FT-470	**ICOM IC-32AT**	**KENWOOD TH-75A**
Memory Channels	42	20	20
VFOs Per Band	2	1	1
Wide Receiver Frequency Range (MHz)—VHF	130-180	138-174	140-164
Wide Receiver Frequency Range (MHz)—UHF	430-450	440-450	438-450
Built-in CTCSS Encode/Decode	Included	Option	Encode Only
Memory DTMF Autodialer	10	None	None
Dual Receive With Balance Control	✓	—	✓
CTCSS Paging	✓	—	✓
Cross Band Full Duplex	✓	✓	✓
Programmable Battery Saver	✓	✓	✓
Backlit LCD Display	✓	✓	✓
Backlit DTMF Keypad	✓	—	—
Alternating Band Scan	✓	✓	✓
Cross Band Repeater	✓	—	—
Power Output on 2 Meter and 440	2.3W	5.0W	1.5W
APO, Automatic Power Off	✓	—	✓
1 MHz Up/Down Stepping	✓	✓	✓
Memory Channels Store Any Offset	42	20	20
Vinyl Case	✓	Option	Option
Odd Split, Tx Or Rx, Any Frequency In Any Memory Channel	42	20	2
Suggested Retail Price	$576.00	$629.00	$549.00

YAESU
FT-411
YAESU
FT-811
YAESU
FT-470

YAESU

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Data and prices obtained from latest available manufacturers' brochures & printed material. October, 1989.

*VHF Radios only.

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KENWOOD

KENWOOD
HF TRANSCEIVER TS-950S
DIGITAL
FUNCTION
METER
FILTER
DATA
SCAN

TS-950SD

"DX-clusive" HF Transceiver

The Ultimate Signal.

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

- **Dual Frequency Receive Function.** The TS-950SD can receive two frequencies simultaneously. The sub-receiver has independent controls for frequency step size, noise blanker, and AF gain and its own digital display!
- **New! Digital AF filter.** Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.
- **New high voltage final amplifier.** 50 V power transistors in the 150-watt final section, results in minimum distortion and higher efficiency. Full-power key-down time exceeds one hour.
- **New! Built-in microprocessor controlled automatic antenna tuner.** The new antenna tuner is faster and you can store the settings in memory! (Manual override is also possible.)
- **Outstanding general coverage receiver performance and sensitivity.** Kenwood's Dyna-Mix™ high sensitivity direct mixing system provides from 100 kHz to 30 MHz. The Intermodulation dynamic range is 105 dB.

Digital Signal Processing

Without DSP With DSP

- **Digital Signal Processor.** DSP is a state-of-the-art technique that maximizes your transmitted RF energy. Your signal stands out because it is much more pure than your competition! You can even tailor your transmitted CW or voice signal waveshape!

- **High performance IF filters built-in.** Select various filter combinations from the front panel. For CW: 250 and 500 Hz, 2.4 kHz for SSB, and 6 kHz for AM. Filter selections can be stored in memory!
- ***Multi-Drive Band Pass Filter* (BPF) circuitry.** Fifteen band pass filters are available in the front end to enhance performance.
- **Famous Kenwood interference reduction circuits.** SSB Slope Tuning, CW VBT (Variable Bandwidth Tuning), CW AF tune, IF notch filter, dual-mode noise blanker with level control, 4-step RF attenuator (10, 20, or 30 dB), switchable AGC circuit, and all-mode squelch.
- **Built-in TCXO for highest stability.**
- **Built-in electronic keyer circuit.**
- **100 memory channels.** Store independent transmit and receive frequencies, mode, filter data, auto-tuner data and CTCSS frequency.
- **Digital bar meter.**

Additional Features: • Built-in interface for computer control • Programmable tone encoder • Optional VS-2 voice synthesizer • Built-in heavy duty AC power supply and speaker • Adjustable VFO tuning torque • Multiple scanning functions • MC-43S hand microphone supplied

Optional Accessories
• VS-2 Voice synthesizer • SP-950 External speaker w/AF filter • SM-230 Station monitor w/pan display • SW-2100 SWR/power meter • TL-922A Linear amplifier (not for QSK)

Specifications, features and prices subject to change without notice or obligation.
Complete service manuals are available for all Kenwood transceivers and most accessories.

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